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"CHAUTAUQUA" TYPE PASSENGER LOCOMOTIVE.

Chicago, Rock Island & Pacific Railway.

Built by the Brooks Locomotive Works.

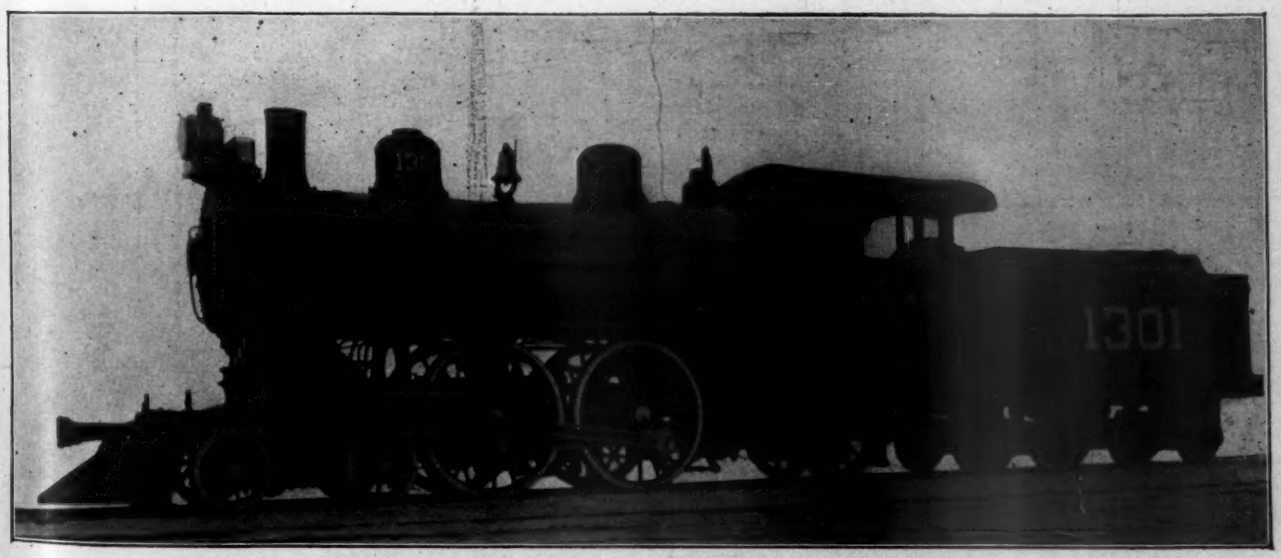
A noteworthy fast passenger locomotive has been built by the Brooks Locomotive Works for the Chicago, Rock Island & Pacific, which is called by the builders the "Chautauqua" type and is similar in its general features to the one for the Burlington, Cedar Rapids & Northern illustrated on page 375 of our December number of last year. The Rock Island engine is heavier and more powerful and includes several new features, such as box links, a new arrangement of the valve motion, a cast steel mud ring and a new form of ash pan openings. The Brooks radial trailer arrangement is used and the trailer journals are 8 by 4 ins. in size. A good idea of the construction was given last month in connection with the new Lake Shore engines. The trailing wheels are 51 ins. in diameter, the same as those of the first "Chautauqua" type engine.

A very direct and stiff valve motion is secured by the use of box links and straight connections with a parallel motion to pass the forward driving axle. As laid out, the slip of the links is very small and special care was taken to obtain square lead, port opening and cut-off. The side elevation and sectional drawings illustrate the valve motion clearly. In the steam chests special efforts were made to obtain free passages for the steam to reach the valve ports; the exhaust passages are also large, the least area through the cylinder casting being 75 sq. ins. The effect of this in low back pressure is seen in the cards.

The boiler drawings show the curved crown sheet, the form of the firebox, the plate angle braces at the back head and the front tube sheet; also the form of the cast steel mud ring with a 2½-in. lug all around to which the ash pan is attached. This boiler is very high. Its center is 9 ft. 7¼ ins. above the rail and but ¾ in. lower than that of the large 12-wheel locomotive built by the Brooks Works for the Illinois Central. Plates at the front and back water legs support the back end of the boiler with no shoes or pads at the sides. The mud ring slopes to give a depth of 24 in. at the throat.

The frame arrangement is like that of the earlier design referred to, with a single bar in front and with screwed bolts in the corners of the splice to prevent weaving. Other features of the frames, including the cross bracing, will be seen in the drawings.

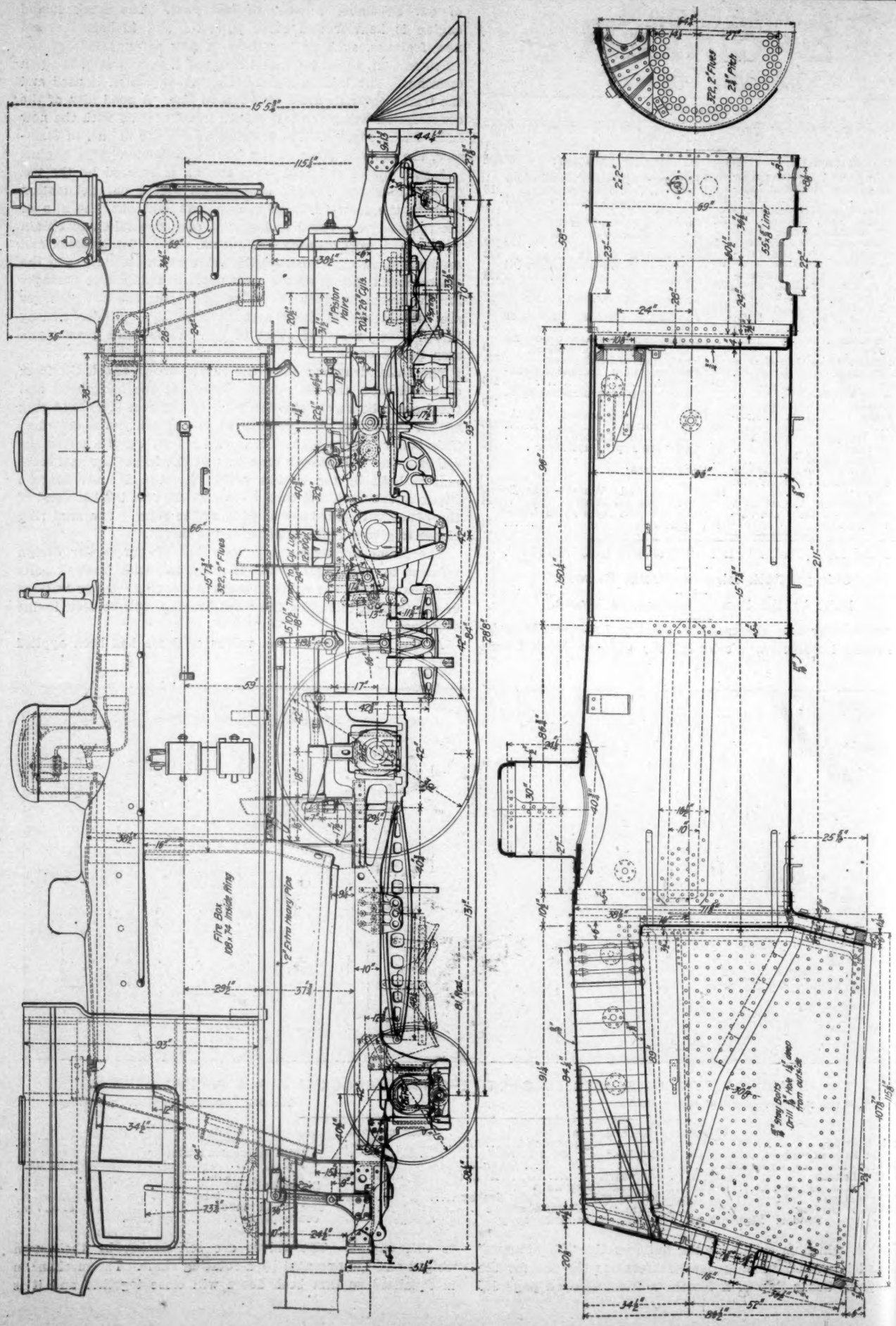
A new design of ash pan valves or doors has been applied to this engine. The valves are self-closing by their own weight and are operated by a rotating shaft. The mechanism is equalized so that both doors will close together and it is



"CHAUTAUQUA" TYPE PASSENGER LOCOMOTIVE—CHICAGO, ROCK ISLAND & PACIFIC RAILWAY.

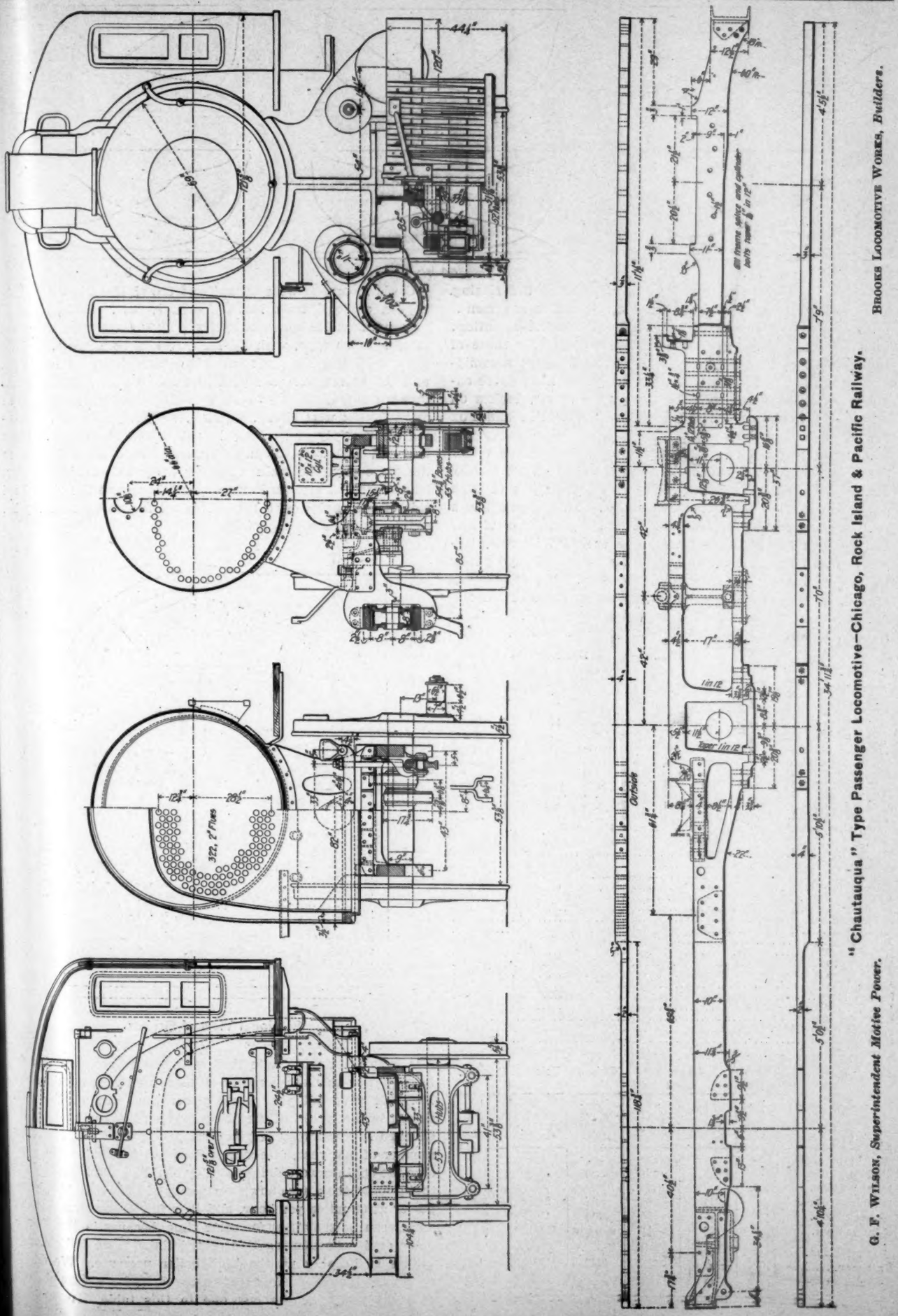
G. F. WILSON, *Superintendent Motive Power.* BROOKS LOCOMOTIVE WORKS, *Builders.*

Cylinders:	20¼ and 26 in.		Boiler pressure	210 lbs.	
Wheel: Driving	78½ in.;	engine truck	36 in.;	tender wheels	36 in.
Weights: Total of engine	167,000 lbs.;	on drivers	93,500 lbs.;	total engine and tender	275,000 lbs.
Grate area and tubes: Grate area	55.7 sq. ft.	Tubes	15 ft. 7¾ in. long.		
Firebox: Length	108 in.;	width	74 in.;	depth front	74 in.; back 64 in.
Boiler: type, wagon top,	radial staying.		Diameter	66 in.	
Heating surface: Tubes	2,617 sq. ft.;	firebox	189 sq. ft.;	total	2,806 sq. ft.
Wheel base: Driving	7 ft. 0 in.;	total of engine	28 ft. 8 in.;	engine and tender	53 ft. 7 in.
Tender: Eight-wheel;		water capacity	6,500 gals.;	coal capacity	8 tons.



"Chatauqua" Type Passenger Locomotive—Chicago, Rock Island & Pacific Railway.

G. F. WILSON, *Superintendent Motive Power.* BROOKS LOCOMOTIVE WORKS, *Builders.*

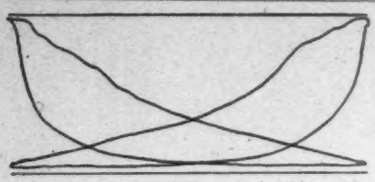


"Chautauqua" Type Passenger Locomotive—Chicago, Rock Island & Pacific Railway.

BROOKS LOCOMOTIVE WORKS, *Builders.*

G. F. WILSON, *Superintendent Motive Power.*

G. F. WILSON, Superintendent Motive Power.



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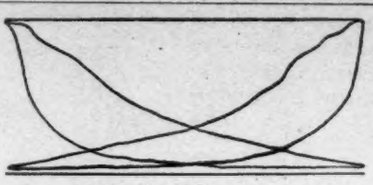

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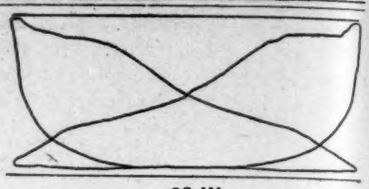

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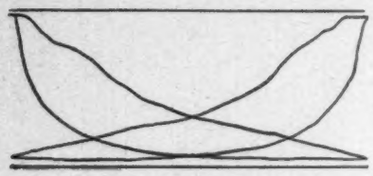

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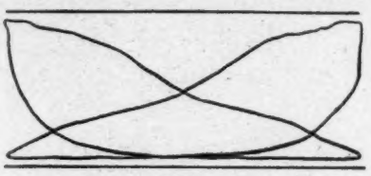

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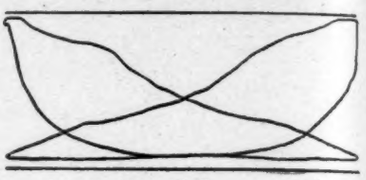


5 E.

arranged to provide for slight obstructions to the closing. Patents have been applied for on this ash pan arrangement.

Among the other details the following attract attention: Cast steel equalizers with three fulcrum points for those of the trailers; cast steel "grab hook" spring hangers; a combination of two fire doors in one as in the recent Lake Shore engines; extended valve rods for the piston valves, brakes on all wheels, including the truck and trailer wheels and Fox trucks under the tender.

We have received two sets of indicator cards taken under the direction of Mr. Wilson from this engine, which are worthy of special attention in connection with the subject of high power capacity of a modern locomotive. This engine has a total heating surface of 2,806 sq. ft. and a grate area of 55.7 sq. ft. This heating surface has been exceeded by other engines, and it seems fair to say that the sustained high power is largely due to the enlarged grate area. We should say that these results add another argument in favor of the improvement in grates which is becoming so general.

Data for Indicator Cards, "Chautauqua" Type Locomotive, Chicago, Rock Island & Pacific Railway.

Card number.	Boiler pressure, lbs.	Revs. per min.	Miles per hr.	Card length. inches.	Front End. Area of card.	Front End. M. E. P.	Front End. I. H. P.	Back End. Area of card.	Back End. M. E. P.	Back End. I. H. P.	Total I. H. P.*
29	207	250	58.2	4	1.89	56.4	298.5	1.95	57.6	293.7	1,184.4
33	202	280	65.2	3.96	1.75	52.8	311.9	1.69	50.4	285.8	1,195.4
23W	210	160	37.2	3.88	3.00	92.4	311.9	3.08	94.8	287.3	1,198.4
7E	205	280	65.2	3.98	1.78	52.8	311.9	1.73	51.6	294.7	1,213.2
44W	203	200	46.5	3.94	2.69	81.6	342.3	2.90	85.2	347.6	1,379.8
5E	205	260	60.5	3.94	2.37	72.1	395.5	2.60	78.0	413.7	1,618.5

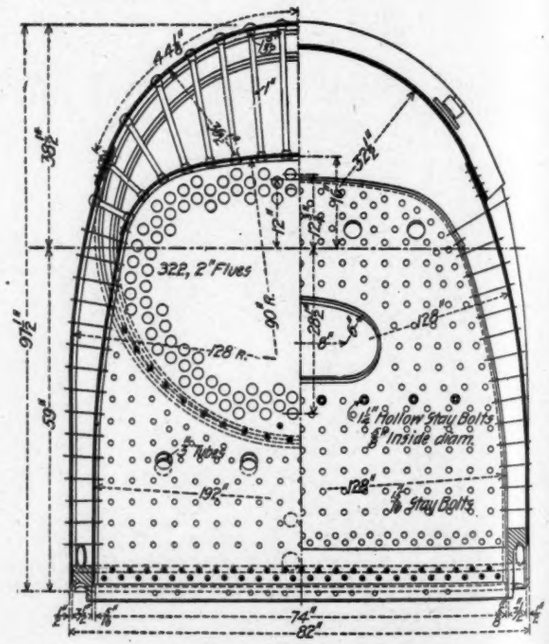
*On the assumption that both sides give the same power.

Valve Motion Characteristics

Valves	Improved piston
Admission	Internal
Motion	Direct, with rockers
Eccentric throw	5½ ins.
Link radius	62 ins.
Link center	59½ ins.
Link centers of eyes	13 ins.
Link lift	13 ins.
Link slip	Maximum, 1¼ ins.; at 6 ins., ½ in.
Saddle offset	9/16 in.
Lifter offset, top	½ in.
Link block above center of axle	1½ ins.
Valve travel	5⅜ ins.
Steam lap	1⅛ ins.
Lead, forward and back	1/16 in.
Exhaust clearance	⅛ in.
Nozzle diameter	5 ins.
Steam ports	1⅞ ins.

	Pre-admission. Front.	Pre-admission. Back.	Lead. Front.	Lead. Back.	Port opening. Front.	Port opening. Back.	Cut-off. Front.	Cut-off. Back.	Release. Front.	Release. Back.	Closure. Front.	Closure. Back.
Forward.	in.		in.		in.		in.		in.		in.	
Full gear.	0		+1/16		+1½		21¼		24½		1½	
16-inch notch...	.....		.....		.....		.....		.....		.....	
12-inch notch...	1/16		¼		5/8		12¼		20¾		5¼	
8-inch notch...	1/8		5/16		5/8		8¼		18¾		7¼	
6-inch notch...	1 3/16		13/16		11/16		6		16¾		9¼	
Back Motion.												
Full gear.	0		+1/16		1⅜		21¾		24¾		1¼	
10-inch notch...	1/16		1/16		11/16		10		18⅛		6⅛	

Cards 29 and 33 were taken from the right-hand side of the engine, on local train No. 1, March 8, 1901, consisting of 10 cars, with 120-lb. indicator spring. The valves were the same, 11 ins. piston type, with 5½-in. travel in both cases, and the lap was 1⅛ ins. On this run the exhaust clearance was 1⅛ ins. and the valves were set with 1/32 in. lead in full gear, both forward and back. Cards 23 W and 44 W were taken on an extra freight west bound, March 6, weighing 640 tons, consisting of 30 empty and 6 loaded cars, chiefly stock cars. Cards 7 E and 5 E were taken on an east-bound extra freight on the same day, the train weighing 341 tons, consisting of 10 loaded cars. These cards were also taken from the right-hand side of the engine with the valves set for no exhaust lap but otherwise the same as before.



Sectional View of Firebox.

It is interesting to note that, with the assumption that the horse-power was the same on both sides of the engine, card No. 5 E gave a higher horse-power than any of the cards shown in the record of the "Northwestern" type engine of the Chicago & Northwestern given on page 335 of our November number of last year, although it does not follow that in either case the engines were doing all they could do. It is noteworthy that a locomotive has shown a capacity of 1,618 indicated horse-power at 60 miles per hour, and it is fair to assume that this power can be sustained for some time, because in the 32 indicator cards constituting this record there is no indication of failure in keeping up the high boiler pressure. We do not recall any indicator cards from a two-cylinder engine showing as great power as the last one in this table. In studying

these results it should be noted that the driving wheels are 78½ ins. in diameter. The service on this road is severe in the number of stops required of fast and heavy trains.

"Chautauqua" Type Passenger Locomotive, Chicago, Rock Island & Pacific Railway.

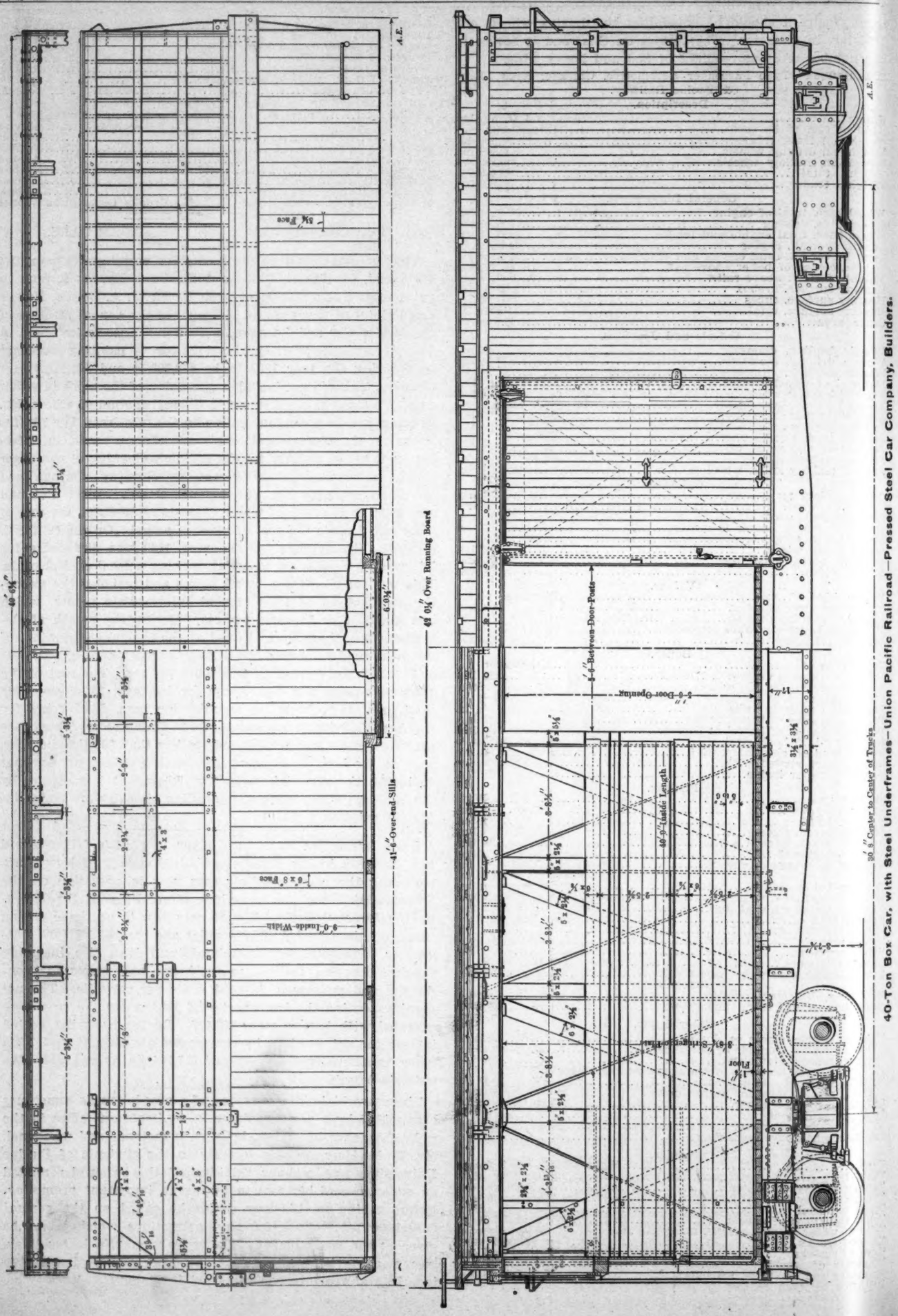
Description.	
Gauge	4 ft. 8½ ins.
Kind of fuel to be used	Bituminous coal
Weight on front trucks	38,000 lbs.
Weight on driving wheels	87,000 lbs.
Weight on trailing wheels	37,000 lbs.
Weight, total	162,000 lbs.
Weight, tender	108,000 lbs.
General Dimensions.	
Wheel base, total of engine	28 ft. 8 ins.
Wheel base, driving	7 ft. 0 ins.
Wheel base, total engine and tender	53 ft. 7 ins.
Length over all, engine	40 ft. 8 ins.
Length over all, total engine and tender	63 ft. 9 ins.
Height, center of boiler above rail	9 ft. 7¼ ins.
Height of stack above rail	15 ft. 6 ins.
Heating surface, firebox	189 sq. ft.
Heating surface, tubes	2,617 sq. ft.
Heating surface, total	2,806 sq. ft.
Grate area	55.7 sq. ft.
Wheels and Journals.	
Wheels, leading, diameter	36 ins.
Wheels, driving, diameter	78½ ins.
Wheels, trailing, diameter	51 ins.
Material of wheel centers	All cast steel
Type of leading wheels	Four-wheel swiveling and swing truck
Type of trailing wheels	Improved radial axle
Journal leading axles	6½ ins. by 11 ins.
Journal leading axles, wheel fit	6½ ins.
Journal driving axles	9 ins. by 12 ins.
Journal driving axles, wheel fit	9½ ins.
Journal trailing axles	8 ins. by 14 ins.
Journal trailing axles, wheel fit	7⅞ ins.
Cylinders.	
Cylinder diameter	20¼ ins.
Cylinder stroke	26 ins.
Piston rod diameter	3¾ ins.
Main rod, length center to center	127 ins.
Steam ports, length	25½ ins.
Steam ports, width	1⅞ ins.
Exhaust ports, least area	75 sq. ins.
Bridge width	3⅛ ins.
Valves.	
Valves, kind of	Improved piston
Valves, greatest travel	5¼ ins.
Valves, steam lap (inside)	1⅛ ins.
Valves, exhaust clearance (outside)	0 ins.
Lead in full gear	1/16 positive
Boiler.	
Boiler type of	Wagon top
Boiler, working pressure	210 lbs.
Boiler, material in barrel	Steel
Boiler, thickness of material in shell	⅝, 11/16, 9/16 and ½ in.
Boiler, thickness in tube sheet	¾ in.
Boiler, diameter of barrel front	66 ins.
Boiler, diameter of barrel at throat	71⅜ ins.
Seams, kind of, horizontal	Sextuple
Seams, kind of, circumferential	Double and triple
Crown sheet stayed with	Radial stays
Dome, diameter inside	30 ins.
Firebox.	
Firebox, type	Wide
Firebox, length	108 ins.
Firebox, width	74 ins.
Firebox, depth, front	74 ins.
Firebox, depth, back	64 ins.
Firebox, material	Steel
Firebox, thickness of sheets	Crown ⅜ in., tube ⅝ in., sides 5/16 in., back ⅜ in.
Firebox, brick arch	On water tubes
Firebox, mud ring, width	Back and sides 3½ ins., front 4 ins.
Firebox, water space at top	Back 7 ins., sides 6 ins.
Grates, kind of	Cast iron, rocking
Tubes, number of	322
Tubes, material	Charcoal iron
Tubes, outside	2 ins.
Tubes, thickness	No. 11 B. W. G.
Tubes, length over tube sheets	15 ft. 7¾ ins.
Smokebox.	
Smokebox, diameter, outside	69 ins.
Smokebox, length from tube sheet	64½ ins.
Other Parts.	
Exhaust nozzle, single or double	Single
Exhaust nozzle, variable or permanent	Permanent
Exhaust nozzle, diameter	5½ ins.
Exhaust nozzle, distance of tip above center of boiler	1½ ins.
Netting, wire or plate	Plate
Netting, size of mesh or perforations	3/16 in. by 1½ ins.
Stack, straight or taper	Cast iron, taper
Stack, least diameter	16 ins.
Stack, greatest diameter	19½ ins.
Stack, height above smokebox	36 ins.
Tender.	
Type	Eight-wheel, steel frame
Tank, type	Gravity slide
Tank, capacity for water	5,500 gallons
Tank, capacity for coal	8 tons
Tank, material	Steel
Tank, thickness of sheets	¼ in. and 5/16 in.
Type of under frame	Steel channel
Type of trucks	Fox pressed steel
Type of springs	Double elliptical and coil
Diameter of wheels	36 ins.
Diameter and length of journals	5 ins. by 9 ins.
Distance between centers of journals	5 ft. 0 in.
Diameter of wheel fit on axle	6¾ ins.
Diameter of center of axle	5⅞ ins.
Length of tender over bumper beams	21 ft. 3 ins.
Length of tank inside	20 ft. 1½ ins.
Width of tank inside	10 ft. 0 in.
Height of tank, not including collar	5 ft. 0 in.
Type of draw gear	M. C. B. coupler
Special Equipment.	
Brakes	American for drivers, Westinghouse for tender and train service
Pump	9½ ins.
Sight-feed lubricator	Nathan
Safety valves	Ashton
Injectors	Nathan
Springs	Scott
Metallic packing, piston rods	Jerome
Metallic packing, valve stems	Brooks Locomotive Works

THE COST OF CLEANING PASSENGER CARS.

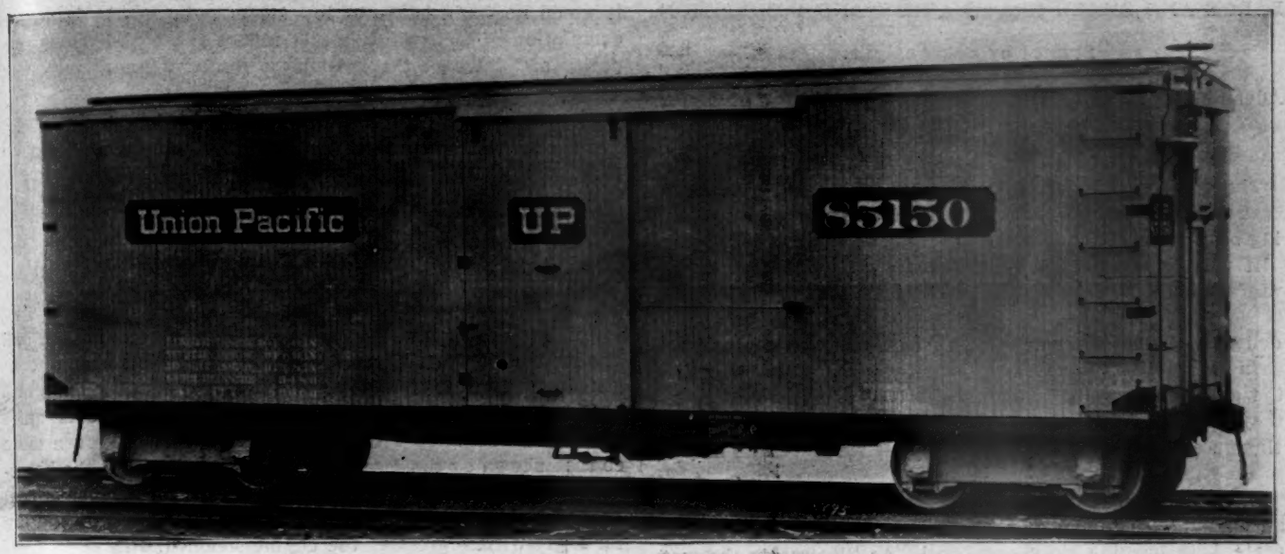
That it costs nearly as much to clean passenger cars on the Cleveland, Cincinnati, Chicago & St. Louis Ry. as it does to paint them was a statement made by Mr. J. A. Gohen, Master Car Painter of that road, in his paper at the annual meeting of the Master Car and Locomotive Painters' Association, held at Detroit last September. He stated the cost of painting passenger cars during the year 1899 to be $53,700.59 and $51,721.41 for cleaning. This did not include supervision of the work in either case. To prove this statement to the satisfaction of others, Mr. Gohen gives, in a communication to the "Railroad Digest" for February, the average cost on eleven different roads, in different parts of the country for the ordinary cleaning of passenger cars at terminals, at about 60 cents per cleaning. On one road the daily cleaning per car for all classes except Pullman amounted to 65 cents, of which 61 cents represented the cost of labor and 4 cents the cost of materials used. On the C., C., C. & St. L. the average for the year 1899 was 38.6 cents for labor and 2.2 cents for material, making a total of 40.8 cents. This was for all classes, at all points and included the sweeping and dusting of local cars at intermediate points, which cost about 10 or 11 cents per car. During the month of December, 1900, there were cleaned at the Cincinnati terminal of the same road 2,494 cars of all kinds except sleepers, at a cost of $1,317.67, an average of 52.8 cents per car. The cost of the different classes was 17.02 cents for baggage, 23.13 cents for mail cars, 40.04 cents for combination cars, 56.05 cents for coaches, $1.22 for parlor and $1.35 for dining cars. These cars are in daily use and are cleaned not less than 300 times a year, making the least yearly cost for cleaning $158.40 per car, not including the materials used. This amount is undoubtedly greater than many roads are spending annually for maintaining the paint on a car.

Some interesting figures are given in a little folder issued very recently by the Compressed Air Company of New York, regarding the compressed-air cars now in operation on the Twenty-eighth and Twenty-ninth street lines of the Metropolitan Street Railway. The 20 cars now in use have during three months traveled 165,000 miles and carried 1,775,667 passengers. The total cost of maintaining this service, including repairs, charging station, power house and wages for conductors and motormen, is 17.42 cents per car-mile. The net earnings during the last quarter of 1898, when the cars were operated with horses, were $18,107. During a similar period in 1900 the net earnings by compressed air were $21,888. This gives an annual net increase of $15,124 on a road only five miles in length.

The proverbial clean sweeping of a new broom is sometimes exemplified by a new appointee to an important office in the radical changes he makes, both as to methods and personnel. Mr. E. M. Herr, talking recently to the students of Purdue University, was perhaps thinking of this when he related an experience of his own in taking an important promotion. Before taking up his new duties he called on the general superintendent to ask for any instructions which might be given at the last moment. The reply was: "No instructions. The machine is running all right down there. Don't stop it until you are sure you can start it again."



40-Ton Box Car, with Steel Underframes—Union Pacific Railroad—Pressed Steel Car Company, Builders.



40-Ton Box Car, with Steel Underframes—Union Pacific Railroad.

40-TON BOX CARS WITH STEEL UNDERFRAMES.

Union Pacific Railroad.

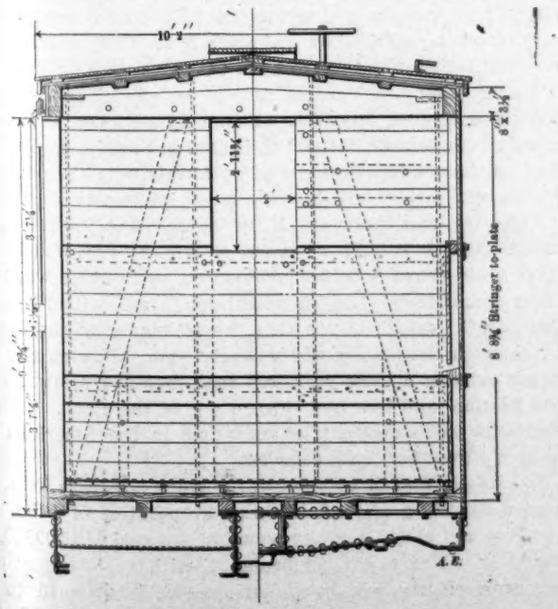
Built by the Pressed Steel Car Company.

An important development of the use of steel in car construction is represented by the design illustrated here by the courtesy of Mr. J. H. McConnell, Superintendent Motive Power of the Union Pacific, and the builders, the Pressed Steel Car Company. The use of steel is not entirely confined to the underframe, but the box portion is almost entirely of wood.

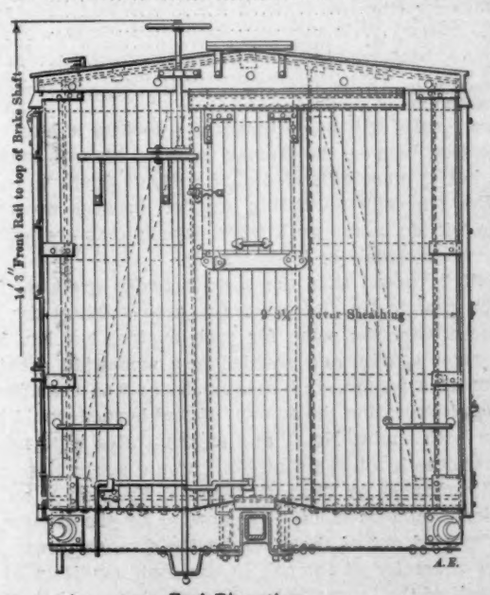
General Dimensions.

Capacity	80,000 lbs.
Light weight	40,300 lbs.
Cubic feet capacity	3,840
Length over end sills	41 ft. 0 in.
Length inside	40 ft. 0 in.
Width over side sills	9 ft. 6⅝ ins.
Width inside	9 ft.
Width at eaves	10 ft. 2 ins.
Height under center of car lines	9 ft. 6 ins.
Height of floor from rail	3 ft. 7¼ ins.
Height of center of drawbar	2 ft. 10½ ins.
Height over all	14 ft. 3 ins.
Height at eaves	13 ft. ¾ in.
Height of door openings	8 ft. 6 ins.
Width of door openings	5 ft. 6 ins.
Center to center of trucks	30 ft. 8 ins.

Pressed steel center and side sills, of the "fish-bellied" pattern peculiar to these builders, form the basis of the underframes, and to these pressed steel end sills are riveted, the draft gear being secured to the center sills and passing through the end sills. The draft rigging is the Pressed Steel Car Company's standard twin spring arrangement. Stiffening angles are riveted to the lower portions of the center and side sills extending a considerable distance each way from the centers. Pressed steel angles placed at 2 ft. 9½-in. centers, riveted between the webs of the center and side sills and the necessary bracing at the ends, complete the metal floor system. Three 4 by 3-in. wooden stringers each side of the center of the car and additional stringers at the side sills form the basis for the floor and the box structure, as indicated in the drawings. The bolsters for the body and truck are of pressed steel.



Transverse Section.



End Elevation.

Pressed steel U-section carlines with pressed sockets for the purlins are secured to the side plates at 5 ft. 3½-in centers, the plates being 8 by 3 ins. in section. A pressed steel angle extends along the outer upper corner of each side plate to form a secure attachment for the carlines. The posts and braces are 5 by 2½ ins. with diagonal rods, and the side door posts are 5 by 5⅛ ins. There are two 6 by ⅞-in. belt rails and also one of pressed steel in U-section 4½ ins. deep. All bolts securing the wood-work to the underframing are ⅝ in. diameter. These cars also have 2-ft. by 2-ft. 11-in. end doors.

Fox pressed steel trucks, 33 in., 650 lbs. cast iron wheels, Buckeye couplers with 6 by 6-in. shanks, cast iron journal boxes, pressed steel brake beams and Winslow roofs constitute the special equipment of the cars.

LARGE AND SMALL GRATE AREAS AND COMBUSTION.

Studied by Gas Analysis.

Advantages of Frequent, Light Firing and Shaking of Grates.

By A. Bement.

The problem of working locomotives with small grate areas that more efficient furnace performance may be secured having been presented, I offer the following as being of interest.

It will be assumed that the larger grate areas have an advantage both in economy and capacity, or that the locomotive boiler with the correct amount of grate area may be able to deliver more horse-power with a reasonable coal consumption than those with the relatively small grates. This being true the great majority of locomotives are at a disadvantage, but they represent an enormous investment, and can neither be thrown away nor changed. Therefore if better results may be secured the subject is an inviting one.

I would also make comparisons between the performance of an engine with a small and another with a moderately large grate, both burning bituminous coal. As illustrating the matters in question I submit some data from experiments with two locomotives which are designated as Nos. 1 and 2. The experiments from which the data are taken were made on one trip with each engine over one-half of a division, with the usual train load, and over the entire division on another trip with the usual train load. The first two trips are designated as experiment No. 1 and the other two trips over the entire division as No. 2.

Experiment No. 1, Over One-half of Division.

Engine No.	1	2
Grate surface, square feet	30	40
Heating surface, square feet	2,050	1,950
Ratio grate area to cylinder volume	6.86	9.39
Ratio heating surface to grate area	68.3	48.9
Ratio heating surface to cylinder volume	481	447
Maximum draft over fire in inches of water	3.25	2.25
C O_2 average for trip	11.07	11.90
O average for trip	4.50	6.06
C O average for trip	2.33	0.17
C O_2 at end of trial	11.90	12.20
O at end of trial	2.30	5.80
C O at end of trial	3.30	0.50
C O_2 maximum	11.90	12.20
C O maximum	3.30	0.50

These results will be assumed to represent average prevailing practice, because the fireman followed his own methods entirely, but it must be stated that without doubt it was better than the generally prevailing practice, because we well know firemen will do better work when experiments are being made, either unconsciously or intentionally.

It will be noted that the ratio between grate surface and draft is practically the same for each engine, the cylinder diameters were the same for each engine, but No. 1 is of 2 ins. greater stroke, and entitled to a somewhat greater train load for this reason, and because there was considerable incomplete combustion the amount of coal burned would be greater than with engine No. 2, and as the grates were not shaken in either case it follows that No. 1 would accumulate a greater quantity of ashes on 30 sq. ft. than did No. 2 on 40 sq. ft. This condition would be modified somewhat by the greater amount of ash carried out of the stack by the stronger draft of No. 1, but the character of the ash in the coal, condition of the fire at the end of the trip and the gas analysis proved that this was too small an item to be of material consequence.

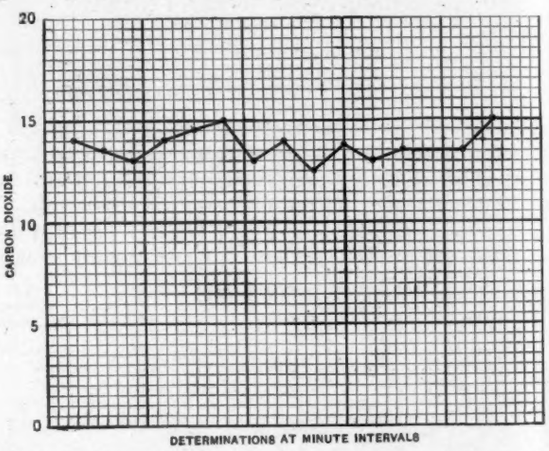
This performance I think illustrates very clearly the relation between the two grates in common everyday prevailing practice. No. 2, however, has two other advantages, owing to the lower vacuum in the smokebox less fuel would be thrown out of the stack, which was, of course, an observed fact; and because of a larger exhaust nozzle there is less back pressure.

From the standpoint of the amount of incomplete combustion shown by each engine upon arrival at its destination it is probable that No. 2 could have continued over the entire division with the same manipulation of the fire with no trouble as far as steam was concerned, but not so with No. 1, because it would no doubt suffer by low steam owing to the large accumulation of ash, which would reduce the coal burning capacity and increase the incomplete combustion.

Experiment No. 2, Over Entire Division.

Engine number	1	2
Grate surface, square feet	30	40
Heating surface, square feet	2,050	1,950
Maximum draft over fire in inches of water	2.25	1.62
CO_2, average for trip	12.43	13.10
O, average for trip	6.03	5.96
CO, average for trip	0.00	0.00
CO_2 at end of trial	12.50	14.00
O at end of trial	5.00	3.10
CO at end of trial	0.00	0.00
CO_2, maximum	13.40	14.00
CO, maximum	0.00	0.00
Temperature of escaping gases, average	850°	850°

For this experiment the exhaust nozzles were enlarged, and the method of working the fire was changed; this change consisted simply of firing light and often, and shaking the grate at brief and regular intervals. The performance is quite striking as compared with that of experiment No. 1, even more so than shown by the data, because compared with it the horse-power developed was greater; the speed higher; amount of coal burned in a given time greater; amount of air entering the fire for a given time greater; the engine steamed with great freedom and the pressure was higher, in fact at the blowing-off point under all conditions and upon arrival at the end of the



trip both engines appeared to be in condition to immediately turn around and repeat the performance, as the fire was apparently in as good condition at the finish as at the start.

Referring to the working of small grates the performance of engine No. 1 in experiments Nos. 1 and 2 should be studied, for therein lies the solution of the problem except for those especially large engines with grates but slightly enlarged, yet with very much larger boilers and cylinders. With these air may be admitted over the fire to burn CO, or producing gas, which is made. Changing exhaust nozzles, or admitting air over the fire are measures, however, which I do not consider advisable or safe to undertake without the aid of gas analysis. But grates may be shaken, and fires coaled uniformly with the usual small grates, and results will be very much improved.

Referring to experiment No. 2 as showing the relation between these two sizes of grate, it will be observed that the large grate shows a better combustion, or in other words, produces complete combustion with less air, and with 28 per cent. less "draft," which shows that the resistance to the inflow of air through the large grate is much lower, allowing the use of larger exhaust nozzles with less back pressure, a lower smokebox suction, and less fuel thrown out of the stack. This is in line with my statement in an article in the American Engineer of November, 1900, page 346.

The loss in fuel thrown out of the stack is a large item. With a good condition of combustion an evaporation of 7 lbs. of water from and at 212 deg. per pound of dry coal of 13,000 B. T. U. would be an excellent performance, with an efficiency of 53.5 per cent. If the loss by radiation, etc., is assumed to be 10 per cent., and that in the hot gases at 23, there would still be

13.5 per cent. to be accounted for in the fuel thrown out of the stack. In addition, the convenience and comfort to passengers that would result from the reduction of this loss is an item of no small importance.

The ideal condition for combustion, as far as quantity of air supply is concerned, is that the air be automatically supplied in proportion to the boiler load. This is a condition which the locomotive meets in an ideal manner. As Prof. Goss has stated in a recent paper before the American Society of Mechanical Engineers, the draft-producing power is in proportion to the weight of steam discharged in the exhaust, and as this is the same as that produced by the boiler the air supplying power is automatic. This is a matter of considerable importance, and it may be said—in view of the fact that there is a more or less general belief that a locomotive is at a serious disadvantage as compared to stationary boilers, on account of its changing load—that this lack of automatic air supply, as compared with the load, is one of the most serious difficulties experienced with stationary boiler fires.

The proper quantity of air supply being insured, it follows that there should be fed that amount of coal that will satisfy it. This coal feed should be as uniform as possible, and its quantity should be in proportion to the quantity of the air. To this end in experiment No. 2, it was first intended to keep the grate free and open, by shaking out the accumulating ash and clinker before it had time to form in large mass; and second, to keep the fire in a uniform, level and even condition, and of a depth that would be called a thin fire; third, to supply the coal at a more or less rapid rate according as the steam pressure showed a tendency to raise or lower. With this method any effort to bring down the steam pressure by working the engine harder, was met with more intense furnace action and the pressure remained unchanged; with either engine in experiment No. 2 there was no time when there was not steam enough. In fact, there was no opportunity to work the boilers at their maximum. This performance implies more care and intelligent effort on the part of the fireman, but it also means quicker and more satisfactory trips over the road for freight trains, and less delay to passenger trains, and also a saving of coal.

The quality of work performed by the firemen, in stationary practice, I have found to be such an important factor, that as a rule I am led to measure boiler horse-power by the number of men and the quality of their work, rather than by square feet of grate, and heating surface. This applies to mechanical stokers as well as to hand-fired furnaces. As a combustion-producing apparatus I consider the locomotive entitled to a position of first importance, but as with any other it must be worked at its best.

The accompanying diagram shows the carbon dioxide taken at minute intervals from engine No. 2, which illustrates a very uniform condition of combustion for a locomotive.

The foregoing data and remarks refer to running conditions, and take no account of what takes place when steam is shut off or stops are made. Under such conditions, of course, the performance is quite different, but there are times when but little coal is being burned, and for this reason the combustion losses are proportionally small. Some analyses will show these peculiar conditions, for example:

(1).....	CO_2	11.1
	O	5.9
	CO	1.5

This was caused by steam being shut off during a portion of the time that the sample was being collected.

(2).....	CO_2	12.1
	O	2.2
	CO	5.2

This was caused by the fire getting into very bad condition.

(3).....	CO_2	13.9
	O	4.3
	CO	0.4

This small amount of CO resulted from some fine slack which had accumulated as the coal in the tender became low, and this was fired while the sample was gathered, otherwise combustion would have been complete, even with smaller air supply. These three analysis are not, however, from the two experiments mentioned above.

The various gas samples were uniformly gathered during a period of about ten minutes, and immediately analyzed, the results being available for guidance in the working of the fire.

ENGINE FAILURES ARE BECOMING EXCEEDINGLY IMPORTANT.

It is not long since 5,000 miles per month was satisfactory mileage for a passenger engine. Now it is often double that. The great increase in the volume of traffic makes it a serious matter to delay a train and there are also the expense of repairs and the loss of service of the engine while in the shop for repairs to be considered. A superintendent of motive power recently said that if he could do so he would build a locomotive all in one piece, because the liability of failure increased rapidly with the degree of complication. It is clear that inspection in the roundhouse must be most carefully done and that it must be extended to include everything about the locomotive. Inspectors discover many broken parts and if these are repaired or replaced without record, an excellent opportunity for improvement in the direction of reducing the difficulties is lost. Several years ago Mr. Quayle issued to the various Master Mechanics of the Chicago & Northwestern a series of blank forms upon which were printed in copying ink diagrams of eccentrics, straps, piston rods, axles, driving boxes and other parts specially likely to fail in service. These diagrams and blanks served as a record of the fracture, its character and location in each case being reported and indicated on the diagrams, and from them the drafting room secured most valuable information for guidance in increasing strength where it was most needed. The result after four or five years is pleasing, the number of parts failing having been greatly reduced as the points of weakness developed. For example, if a number of eccentric straps broke in the same or nearly the same way it was easy to locate the weakness and remedy it by the addition of material where it was necessary. The time may come when engine failures will be considered unnecessary, but at present it is an unusual record which does not show more than five failures per locomotive per year as an average, a failure in this case meaning a breakdown on anything which will cause a delay of three minutes, which cannot be made up. Close inspection and comparative records have accomplished a great improvement on several roads where systematic efforts are being made.

Mr. Joseph H. McConnell, Superintendent of Motive Power and Machinery of the Union Pacific, has resigned, and will be succeeded by Mr. Samuel Higgins, Superintendent of Motive Power of the Lehigh Valley. Mr. McConnell entered railroad service in 1861 at the age of 18 years as an apprentice in the machine shops of the Great Western, now the Wabash, at Springfield, Ill. Later he was a machinist for four years with the Chicago, Burlington & Quincy and Chicago & Alton. In 1868 he became General Foreman of the Union Pacific shops at Omaha, which position he held until 1872. From 1872 to 1885 he was Division Master Mechanic of the Union Pacific at North Platte, Neb., and from 1885 to 1886 was Master Mechanic of the Nebraska Division of the same road. The two years, 1886 to 1888, were given to mercantile pursuits, at Omaha, and during 1889 and 1890 he was occupied in reorganizing the motive power department and other special work on the Union Pacific. In February, 1891, he was appointed Superintendent of Motive Power and Machinery of that system, which position he now leaves. Mr. McConnell has had a long and remarkably successful railroad experience and feels that he has reached a point where he needs a rest. It is not known at this time to what he will direct his attention, but whatever field it may be, he has the best wishes of the American Engineer and Railroad Journal for a continued success. In the work of the Master Car Builders' Association and the Railway Master Mechanics' Association Mr. McConnell has for the past ten years been very active. His work has been recognized as valuable in the report of committees, and as President of the Railway Master Mechanics' Association during the year 1899-1900.

BLOOMINGTON SHOP IMPROVEMENTS.

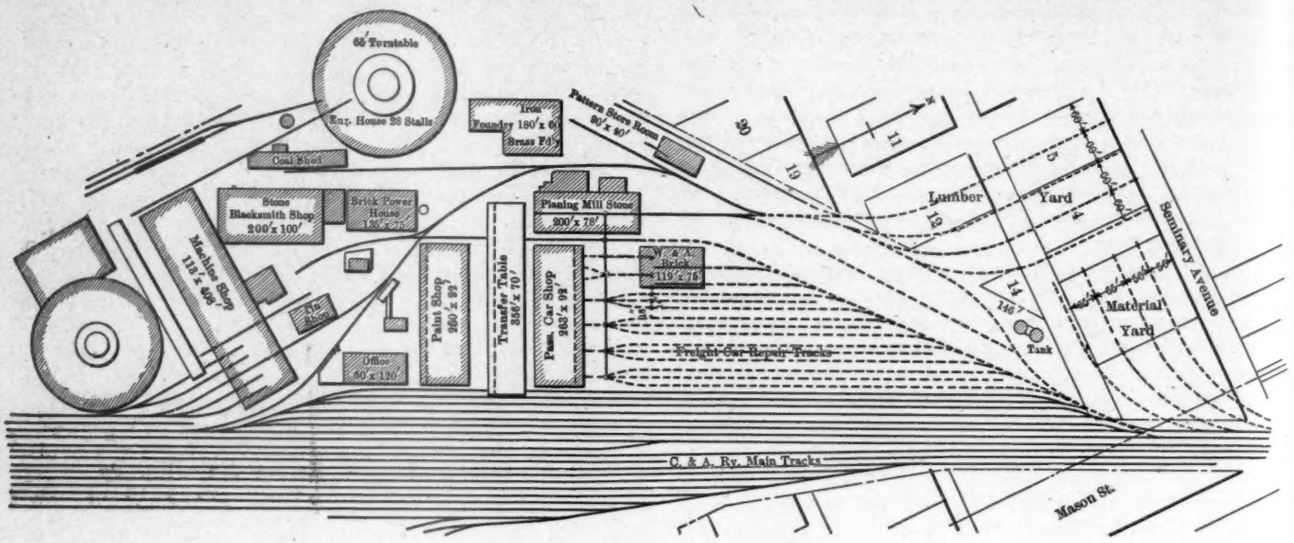
Chicago & Alton Railroad.

An important part of the policy of the management of the Chicago & Alton Railroad is to improve its roadbed, rolling stock and all its facilities to an extent which will place the road in first-class condition generally. In connection with this plan the shop facilities at Bloomington are being enlarged and provisions are made for still further extension when it shall become necessary.

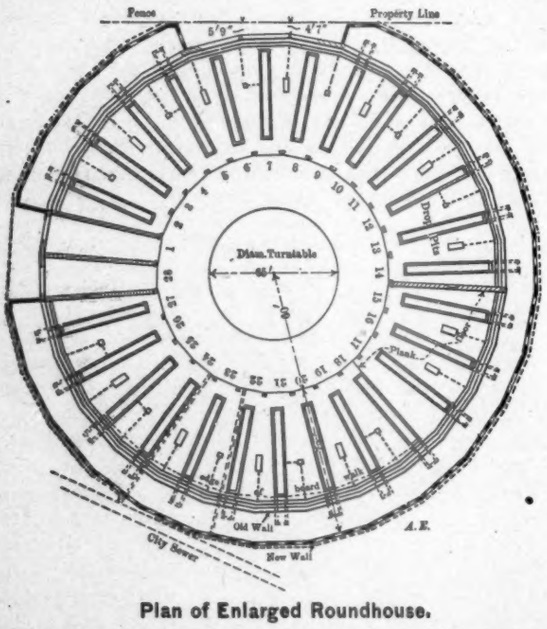
The improvements in these shops are of special interest, because they indicate methods of extending existing structures, at comparatively little expense, for the accommodation of modern equipment. The principal buildings at Bloomington were erected in 1883 and being of stone, it was desirable to use them, and but two new buildings will be erected at present. The paint shop and passenger car shop will be widened 18 ft. each, the transfer table widened from 60 to 70 ft., and the roundhouse enlarged and supplied with a 65-ft. turntable. In connection with this work a new power house, 135 by 75 ft., and a new wheel and axle shop, 114 by 75 ft., are being erected. Electricity will be used to distribute the power, and this part of the improvement will be taken up by us later.

The wheel and axle shop is a part of a large car shop building, only the west end of which is to be built now. The plans provide for a length of 263 ft. when the building is completed. This building has a very high roof with a generous number of ventilators and skylights. The tracks are alternately 18 and 28 ft. centers with a material track in the center of the 28-ft. space. Seventy-pound rails are used for the work tracks and 40-lb. for the others. The roof is of slate supported on trusses of steel, except the compression members, which are of wood. At the end to be used for machinery the bottom chords are made strong enough to support the shafting. The floor of this shop is 3-in. plank, laid on a bed of cinders 12 in. deep.

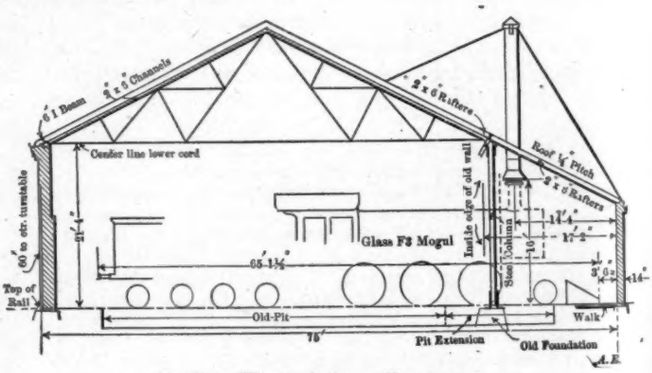
As the paint shop was only 71 ft. 8 ins. wide and a modern passenger car over vestibules requires 78 ft., an 18-ft. extension was provided, which leaves 5 ft. 10 ins. inside the walls at each end of a car of this length. One wall of this building was


65' Turntable
Engine House 28 Stalls
Iron Foundry 180' x 60'
Brass Fdy.
Pattern Store Room 90' x 80'
Coal Shed
Stone Blacksmith Shop 200' x 100'
Brick Power House 135' x 75'
Planing Mill Stone 200' x 75'
Machine Shop 113' x 400'
Paint Shop 360' x 99'
Transfer Table 350' x 70'
Pass. Car Shop 263' x 99'
Brick 119' x 75'
Office 60' x 120'
Lumber Yard
Material Yard
Seminary Avenue
Tank
Freight Car Repair Tracks
C. & A. Ry. Main Tracks
Mason St.

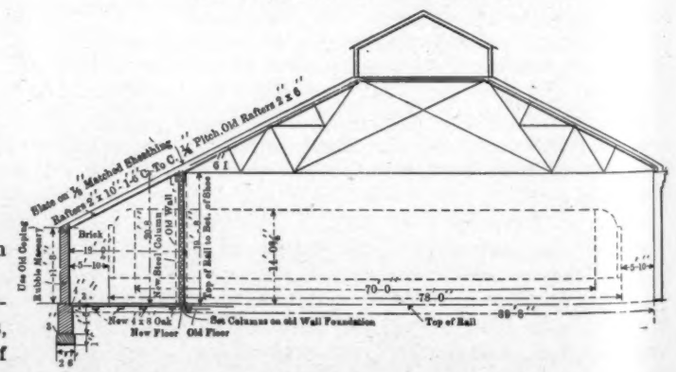
General Plan Showing Extensions



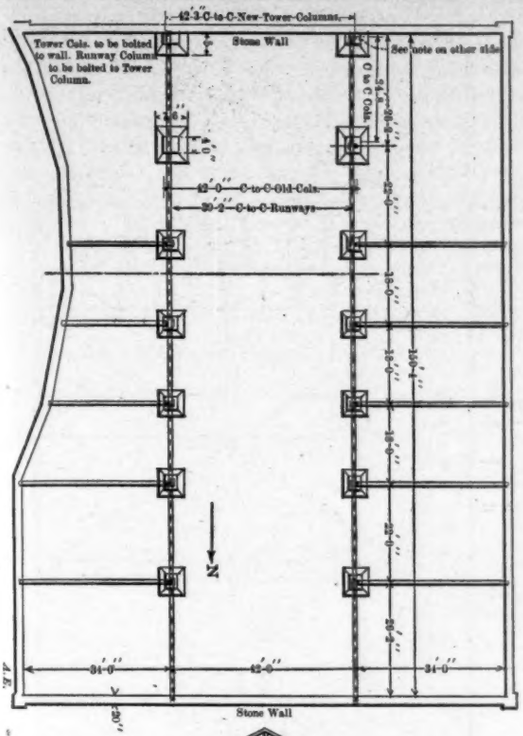
Plan of Enlarged Roundhouse.

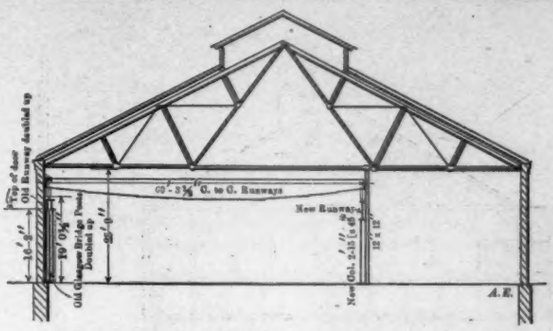


Section Through Roundhouse.

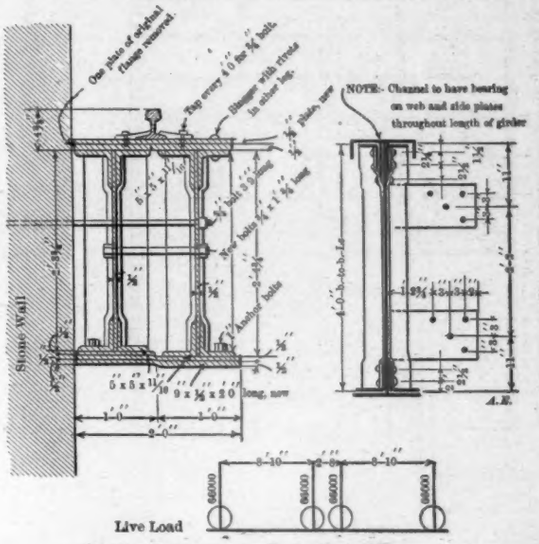


Section of Enlarged Passenger Car Shop.

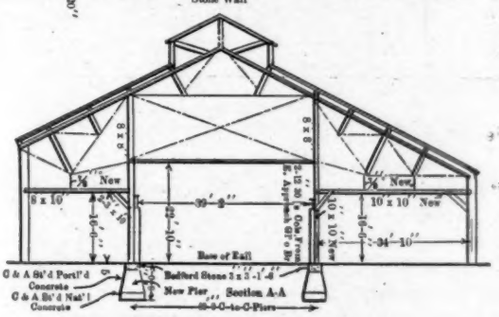



Top of new Old Runway doubled up
63'-3 1/8" C. to C. Runways
New Runway
Old Glasgow Bridge Posts Doubled up
New Col. 2-15 I @ 42
12 x 12
A.E.

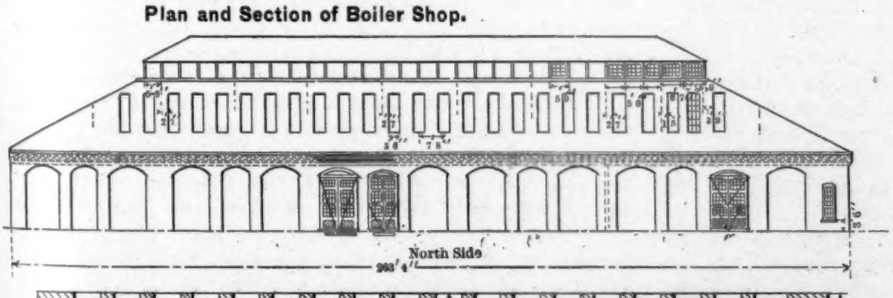
Section Through Machine and Erecting Shop.

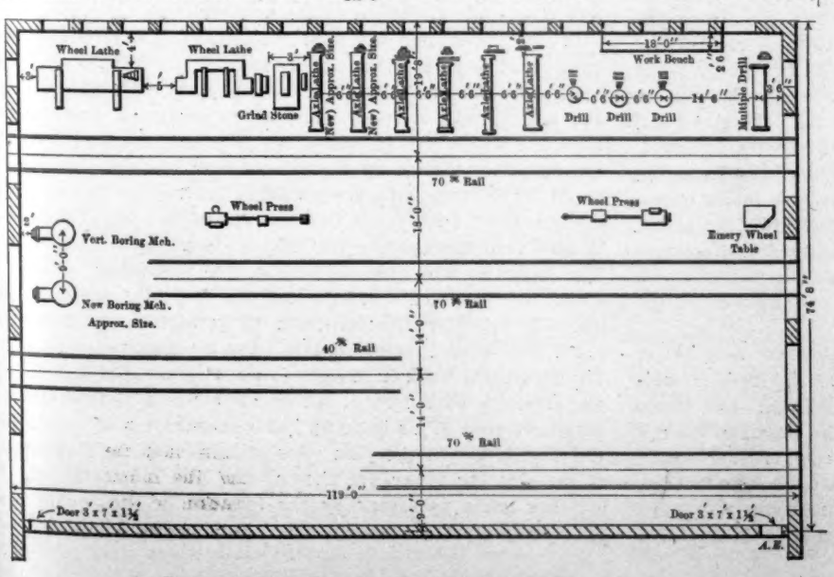


Crane Runways in Erecting Shop.

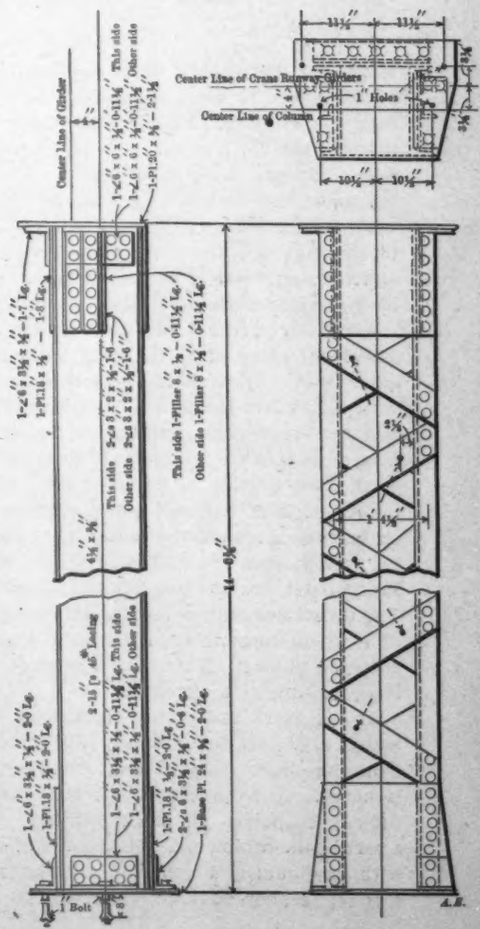


Plan and Section of Boiler Shop.

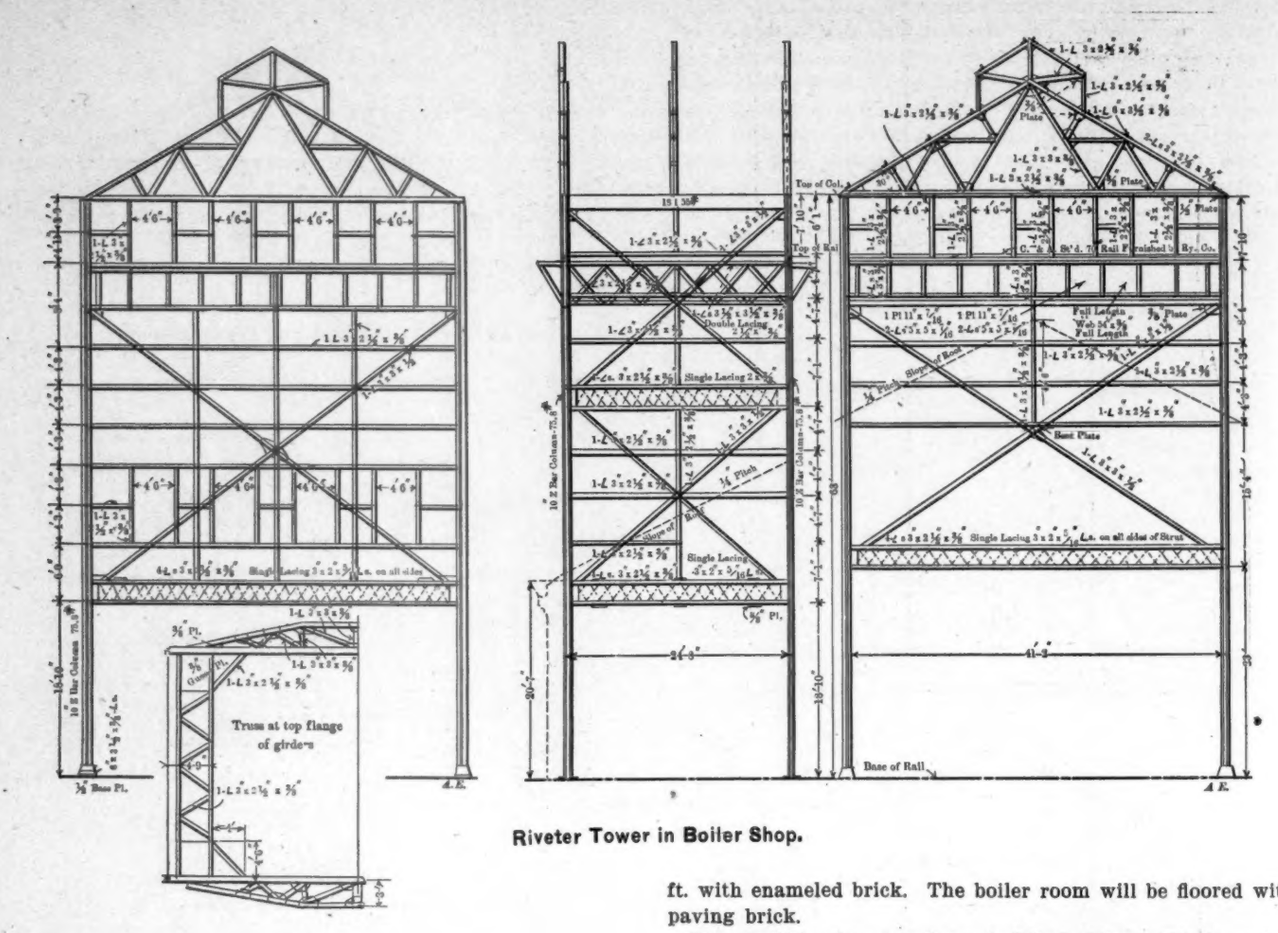




Plan and Side Elevation of New Car Shop.


Center Line of Crane Runway Girders
Center Line of Column
1" Holes
Center Line of Girder
This side
Other side
1-Pl.20 x 3/4 - 0'-11 1/2" Lg.
1-Pl.18 x 3/4 - 1'-6" Lg.
1-Pl.18 x 3/4 - 1'-7" Lg.
2-Pl.8 x 3/4 - 1'-6"
2-Pl.8 x 3/4 - 1'-7"
1-Filler 6 x 3/4 - 0'-11 1/2" Lg.
1-Filler 6 x 3/4 - 0'-11 1/2" Lg.
11'-6 3/4"
1 Bolt
A.E.

Crane Columns in Erecting Shop.


Truss at top flange of girder
Base of Rail
Top of Col.
Top of Rail
Single Lacing
Double Lacing
Slope of Roof
Base Plate
Full Length Web Plate
Single Lacing 3 x 2 x 5/16 c.c. on all sides of Strut
Single Lacing 3 x 2 x 5/16 c.c. on all sides
41'-2"
24'-3"

Riveter Tower in Boiler Shop.

taken out and rebuilt on a new foundation 18 ft. away, and high enough to meet the rafters of the main roof extended over the addition. New steel columns were built to take the place of the old wall and the roof trusses remained as before. Some changes were made in the varnish and upholstering rooms, at the ends of this building, including an electric elevator at the east end of the building. The varnish room is in the east end, the third floor having been taken out. The upholstering room is in the west end. In this shop there are 27 wire-glass skylights 14 by 3 ft. in size.

A similar method was used to extend the roundhouse, an additional space of 17 ft. being built on by removing the old outer wall, replacing it by steel columns and rebuilding the wall in its new location. The pits were extended 14 ft. 3 ins. and the space from wall to wall is now 75 ft., whereas the largest engine on the road is about 65 ft. long. The rafters of the new portion of the roof are 2 by 8 ins., the slope and construction of the roof being such as to be easily extended, an extension toward the center of the turntable was suggested by roofing over the turntable space, but it was found necessary to put the addition outside to save crowding the space. The turntables on this road are all being enlarged to diameters of 70 ft. to accommodate the large engines, but this one was enlarged to 65 ft. This roof is of slate, as are those of all the large buildings in the plant.

At the north end of the blacksmith shop is the new power house, a substantial building 134 by 74 ft. A link-belt coal-handling plant is provided, together with ash and cable trenches. A 7-ton crane will run over the engines upon a runway supported on brick pilasters. A coal crusher forms a part of the equipment. The roof is of slate upon steel trusses, with skylights and ventilators. The engine room will have a concrete floor and the walls will be lined to a height of 6 ft. with enameled brick. The boiler room will be floored with paving brick.

The machine shop is a large building, 404 by 110 ft., and is not to be enlarged. The crane service, however, will be doubled in capacity. Two 22½-ton cranes will be replaced by two of 50 tons capacity each, and the runways will be strengthened accordingly. The tops of the doorways in this building are 16 ft. 2 ins. high, which made it necessary to secure the necessary strength in a shallow runway at the wall side, otherwise the roof trusses would need to be raised. The old runways were doubled together with a cover plate on top and bottom and these were placed on posts made from old bridge material. The other runway was made 4 ft. deep and mounted on new columns of 15-in. 45-lb. channels with lattice bracing. These cranes have a span of 60 ft. 3½ ins. One of the engravings shows the diagram of the wheel loads of the cranes and others show sections of the two runways.

In the boiler shop the improvements consist of a new shop crane and a steel riveting tower with its crane. Riveting towers usually derive some of their support from the building, but in this case it is an independent structure, and for this reason it seems worthy of record. The crane girder is double braced and stiffened by a lattice girder of angles at its top chord. The crane rails are placed at 24 ft. 8 ins. centers. The tower is 41 ft. 2 ins. by 24 ft. 8 ins. and 63 ft. high at the eaves. It passes up through the roof of the shop and is covered with 1-in. matched and grooved yellow pine sheathing, outside of which is corrugated iron of No. 20 B. W. G., the sheathing being used to protect the iron from the gases from the shop. The tower has wind bracing and is liberally supplied with girts. The structural work is in accordance with the standard bridge specifications of the road. In the tower is a 17-ft. stake hydraulic riveter. This building has a slate roof with ventilators and skylights. In the plan view of this shop the foundations of the riveting tower are shown, also the indentation in the building made necessary by the location of the roundhouse. In order to accommodate the shop crane having a span of 39 ft.

2 ins. the roof trusses were raised by a change in their lower chords, the crane columns and foundations being shown in the drawings. This shop crane runs to the end of the building where it will raise a boiler from the trucks as it is received over the transfer table and to allow it to run to the end of the building a dormer was built into the roof at the end toward the transfer table. The crane columns are made of two 12-in. channels.

A dry lumber shed is also included in the improvements. It is 126 by 20 ft. and has sliding doors along the whole front with slat ventilators over the doors. It has a gravel roof.

Dr. Carl Auer von Welsbach, of Vienna, Austria, has been awarded the Elliott Cresson Medal by the Franklin Institute, for his discoveries regarding the metallic oxides which may become incandescent when heated, and for the invention of the Welsbach mantle, by the use of which these metallic oxides are commercially available as sources of artificial light.

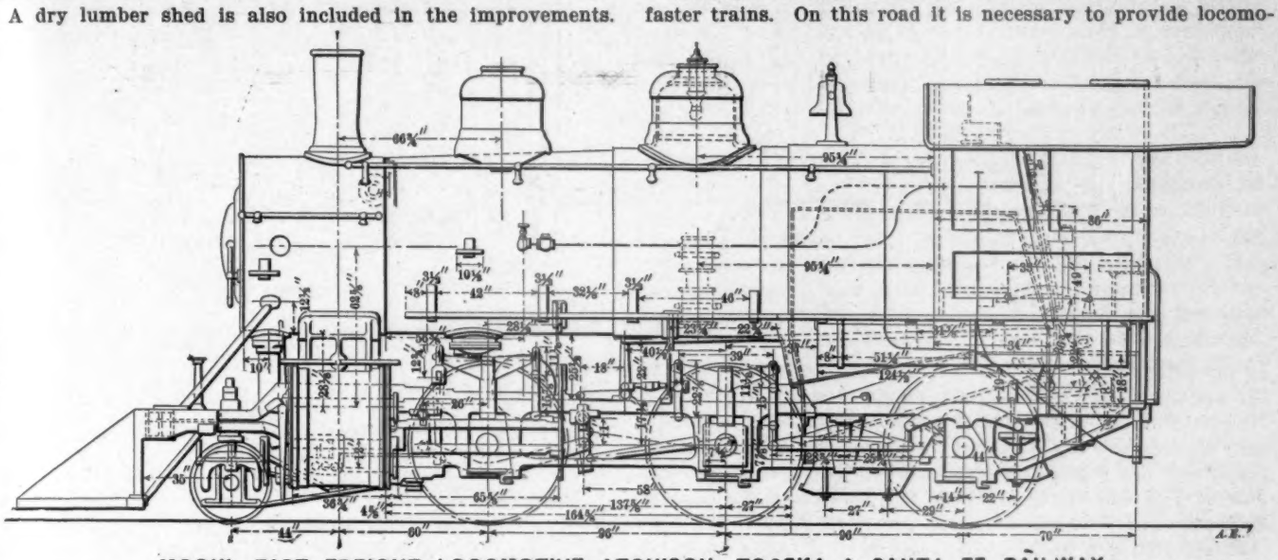
MOGUL FAST-FREIGHT LOCOMOTIVES.

Simple and Compound with Wide Fireboxes.

Atchison, Topeka & Santa Fe Railway.

Built by The Baldwin Locomotive Works.

In freight service the general tendency seems to be toward faster trains. On this road it is necessary to provide locomotives for freight purposes that are not far from the recent passenger designs as regards speed and capacity for sustained power. On this road freight trains must run on relatively fast schedules except on the very heavy grade districts, and the designs here shown are almost equally well adapted to deal with heavy passenger as well as freight traffic. These engines are a part of a large order, some of which are compounds, the drawings being of the compounds, while the table

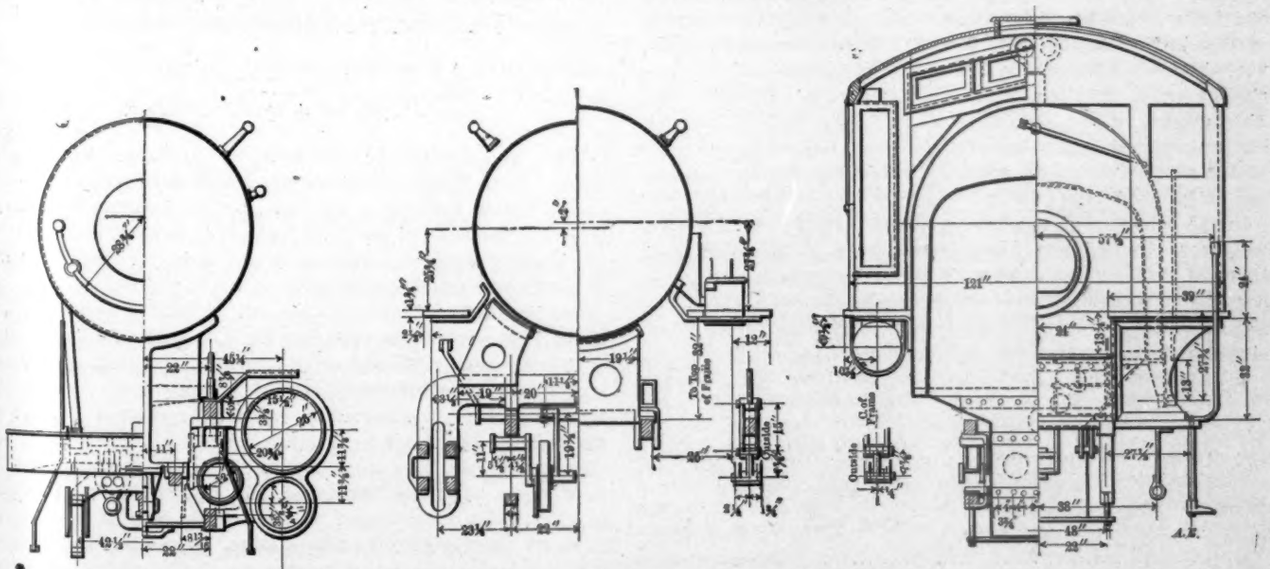


MOGUL FAST FREIGHT LOCOMOTIVE—ATCHISON, TOPEKA & SANTA FE RAILWAY.

JOHN PLAYER, *Superintendent Motive Power.*
R. P. C. SANDERSON, *Assistant Superintendent Motive Power.*

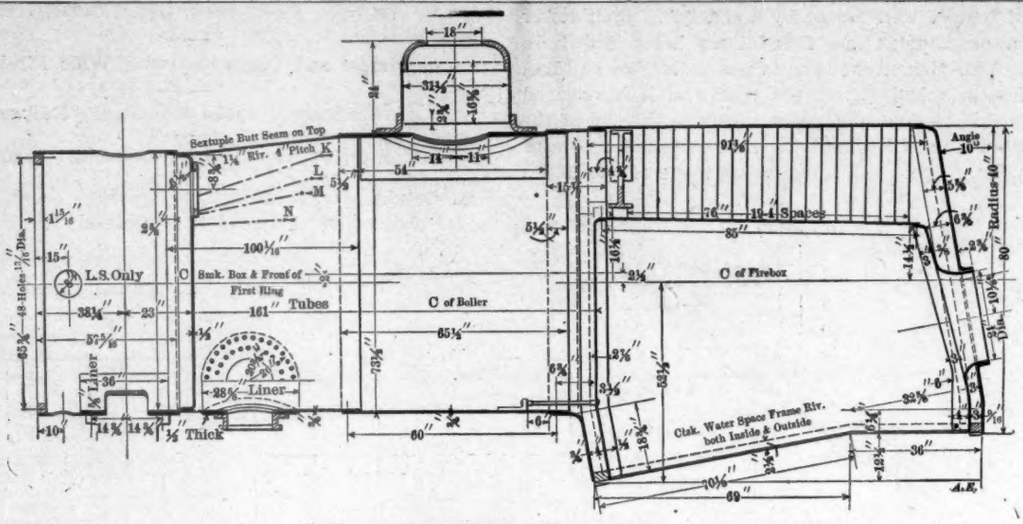
BALDWIN LOCOMOTIVE WORKS, *Builders.*

	Cylinders: 15½ and 26 x 28 in.		Boiler pressure	200 lbs.	
Wheels: Driving	62 in.;	engine truck	30 in.;	tender wheels	33 in.
Weights: Total of engine	159,000 lbs.;	on drivers	135,000 lbs.;	total engine and tender	259,000 lbs.
Grate area and tubes: Grate area	48 sq. ft.	Tubes		350; 2 in., 13 ft. 5 in long.	
Firebox: Length	100¾ in.;	width	71¼ in.;	depth of, front 69 in.;	back 54⅛ in.
Boiler: type, wagon top	radial staying.		Diameter		68 in.
Heating surface: Tubes	2,443.4 sq. ft.;	firebox	155 4 sq. ft.;	total	2,598.8 sq. ft.
Wheel base: Driving	16 ft. 0 in.;	total of engine	24 ft. 8 in.;	engine and tender	51 ft. 4 in.
	Tender:	water capacity	5,000 gals.		



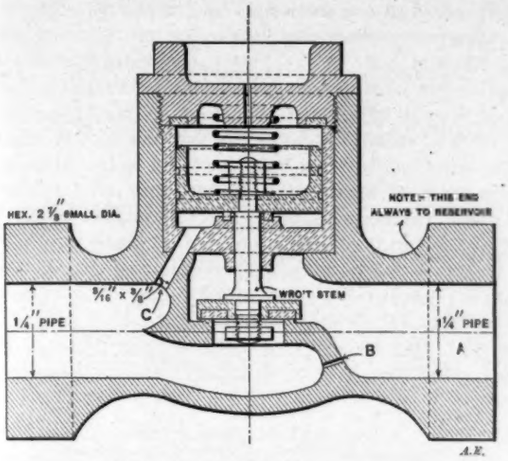
Top of Rail

Sections and Half Rear Elevation.


Sextuple Butt Seam on Top
L.S. Only
C Smk. Box & Front of First Ring
Tubes
C of Boiler
C of Firebox
Liner
Liner
Thick
Clak. Water Space Frame Blv. both Inside & Outside
Angle
Radius-40
15-1 Spaces
Dia.
Dia.
Dia.

the accompanying diagram, which seems to meet the requirements and permits of braking any number of cars by the leading engineer of two or three engines. Mr. Morris says he has no difficulty in braking 75 or 80 cars in this way.

Two of these valves are placed in the additional reservoir pipe on each engine, one toward the pilot and the other toward



Morris' Equalizing Check Valve.

the rear end, with the end of the valve marked A in the engraving, toward the reservoir in each case.

In operation the reservoir pressure enters this valve fitting at the end, A. The large valve will be closed by the spring and pressure and held upon its seat, but the small leakage groove, B, permits the pressure to equalize through the hose connections until by means of the port C and the piston, the valve is raised from its seat and a free passage is opened for the air in the reservoirs. In case a hose bursts on a pair of couplings break the valve closes and reduces the leakage to the amount which can pass through the leakage groove, B. The piping is supplied with the usual cut-out cocks. Mr. Morris has also sent us a pipe plan for the complete equipment of the locomotive, but it is believed that the use of the valve is made clear by this description.

With this arrangement the old 8-in. air pumps do very well, although one of them alone is insufficient. Mr. Morris has applied for a patent on the device.

ROAD TESTS OF DRAFT GEARS.

Atchison, Topeka & Santa Fe Railway.

Mr. R. P. C. Sanderson, of the Atchison, Topeka & Santa Fe, has kindly sent us a copy of a report upon road tests of draft rigging which is worthy of record in the present discussion of the subject of improved draft gears. These tests were made on the Chicago division and were divided into two series.

Tests with Empty Cars.

The train was made up with twelve 80,000 lbs. capacity hopcoal cars fitted with Dayton draft gear followed by 35 hopper coal cars fitted with Miner draft gear. Speed observations were taken with a stop-watch and the following tests were made:

Tests 1 to 5 involved emergency applications from 10 to 20 miles per hour. In No. 5 the brakes were cut out of the last six cars and the caboose. Test No. 6 was an emergency application at 20 miles per hour with brakes cut out of the last 12 cars and caboose. No. 7 was at 20 miles per hour, with 18 cars at the rear cut out. No. 8 was at the same speed, but with 24 cars and the caboose cut out. In No. 9 the brakes were cut out on the first 23 cars, also on the engine and tender. The engine pulled out with wide open throttle and lever in full gear. At 10 miles per hour the angle cock on the caboose was opened wide, causing a violent emergency application on the last 24 cars and caboose. The train was brought to a standstill with the engine stalled. No. 10 was like the previous test except that the speed was 20 miles per hour. In No. 11 handbrakes were set up hard on the caboose and last 10 cars. The engine took the slack against them and started ahead, in full gear with wide throttle. This test was repeated four times. No. 12 was made with all brakes cut in. With the train moving at 4 miles per hour, the engine was reversed to bunch the train and then the lever was put into full forward gear with the throttle wide open, causing the engine to plunge forward. This was also tried four times and the remaining test, No. 13, was an attempt by the engineman to break the train in any possible way. Several were tried but were not successful. The following results are quoted from the report:

Results.

It was found impossible to break the train in two with any of the thirteen tests referred to. There was absolutely no damage to any of the draft gears or couplers, but some of the wooden sills showed splits or cracks from the corners of the key-ways where these were grained into the wood sills. This damage, however, was quite insignificant, did not require any repairs and in nowise affected the strength or safe condition of the cars; and if steel center sills were used instead of wood, this trifling damage, of course, would not have occurred. Tests Nos. 7, 8, 9 and 10 were particularly hard on the cars. The conductor of the train refused to stay in the caboose. It was noticed that there was a good deal of recoil from the springs, and this was to be expected, as, with the play in the couplers and the compression of the springs, there was a difference in length of 15 ft. 8 ins. when the train was stretched and when it was bunched. In tests Nos. 9 and 10 the recoil was sufficient to pull the engine back several feet. In spite of all this, it was noticed with surprise that the recoil was gradual always and elastic and free from all jerk, so that this recoil is not likely to cause any damage to the draft gears. From the action of the train it is to be doubted whether the full capacity of all the 188 draft springs was ever fully exhausted.

Tests with Loaded Cars.

These were also made on the Chicago division, and two engines were used. No. 977 had 21 by 28-in. cylinders, 57-in. driving wheels and 200 lbs. steam pressure. No. 590 had 18 by 24-in. cylinders, 63-in. wheels and carried 180 lbs. steam pressure. The train was made up of 80,000-lb. hopper cars loaded with coal with the draft gear arranged as follows: 10 cars Miner, 2 cars Dayton, 16 cars Miner, 5 cars Dayton, 1 car Miner, 2 cars Dayton, 5 cars Miner, 1 car Dayton and finally the caboose. The gross weight of the train exclusive of the engines and caboose was 2,459 tons, but after two tests the load was reduced to 2,005 tons in order to come within the capacity of the engines. The remaining tests were as follows:

No. 3, the brakes were cut out on the six rear cars and the caboose, an emergency application being made at 15 miles per hour. No. 4 was like No. 3, with the cutting out of 12 cars. In No. 5 the handbrakes were set on the last 10 cars and the caboose. Both engines took the slack against them and started forward in full gear, with wide open throttles. This was repeated five times. In No. 6 the angle cock was turned on the ninth car from the rear end and the hose uncoupled between the eighth and ninth cars, thus setting the brakes on the last eight cars. The engines backed up against these and attempted to start the train with these brakes set by taking the slack with the full power of both engines. This was repeated five times, the remaining test being a number of attempts by the engineers to break the train in two in other ways, in which they failed.

Results.

With the exception of some small cracks in the wooden sills where the malleable draft arms were gained into the sills, there was absolutely no damage to any of the draft gears, springs or couplers. The cars, after the tests, were carefully inspected in the day-time by regular car inspectors who searched them thoroughly for any damage. Six of the cars used in this second test were previously used in the first test. Test No. 6 of the second series was exceptionally severe on the cars.

The report also states at this point that the empty car tests of January 23d were nearly a duplication of the Westinghouse tests made at Wall, and that the loaded car tests of January 31st were comparable with the Westinghouse tests at Wilmer-

ding, that the combined tractive power of the two Atchison engines was nearly that of the Union Railway engine at Wilmerding and that the weight of the train in the second Atchison series was in excess of that of the Wilmerding train. In referring to the Westinghouse tests it was stated in the report that the information was taken from the published accounts of the tests.

PROBLEMS OF A TECHNICAL GRADUATE.

Mr. E. M. Herr, General Manager of the Westinghouse Air Brake Company, on February 13th delivered an address before the students of Purdue University. His subject was "Some Problems in the Business Life of a Technical Graduate." Speaking from a wide experience and with a strong feeling of sympathy for his student audience, Mr. Herr was able to anticipate some of the pleasures as well as the disappointments which lie in the path of men about to graduate.

Referring to the prosperous aspect of business enterprises at the present time, he warned his audience not to relax effort if they found the problem of obtaining employment an easy one, for no true progress is made without effort, and he who is compelled by circumstances to struggle hardest is most entitled to congratulation, if progress and advancement is his object. In emphasizing the advantage to the technical graduate of a thorough shop apprenticeship, Mr. Herr discussed the necessity for reducing shop cost in manufacture and showed how necessary it was for the engineer to know for himself the details of doing work. Always remember, he said, that actually doing the planing, turning, drilling or whatever operations are to be performed on a piece of work is by no means all of the labor which the job includes. The handling to and from the tool or machine may, and in many cases does, cost more than the mechanical operations themselves. Always avoid reducing cost at the expense of either efficiency, accuracy or durability. There is often a great temptation to reduce the cost of maintenance or construction in railroad work, or the cost of a product in manufacturing, by sacrificing efficiency or durability. This may enable one to make a favorable record for a while, but so surely will eventually bring disaster and an increased cost for maintenance or operation in railroad work, or a loss of patronage and reputation in manufacturing, that one can safely condemn such practice without hesitation and in a most uncompromising way.

Speaking of the need of early accustoming oneself to carrying responsibility, Mr. Herr reminded his audience that to shirk or fail always weakens the shirker and lessens confidence, whereas every responsibility successfully borne becomes a stepping stone to greater success. In this connection he related an incident in his own experience. Having been appointed to an executive position, the details of which were new to him, he called upon the general superintendent to whom he was to report, for final instructions before proceeding to his post. In response to his questions as to whether there were any instructions to be given, he received the reply, "No instructions! The machine is running down there; don't stop it until you are sure you can start it again!"

Emphasizing the need of care and patience, the speaker cautioned the students by saying that it was easy to work when everything runs smoothly—when, to use a homely phrase, things are coming your way. But a time is likely to come when your most carefully laid plans are likely to be overturned and you fail, perhaps through no fault of your own, but apparently because some other person has been a little careless or inattentive, or has lacked judgment, with the result that your work has not materialized and you yourself are subjected to criticism. It is then very difficult to have the patience to carefully and more thoroughly than before go over the old ground and with greater pains and care reconstruct a more secure foundation, avoiding the weakness which caused the former failure, whether in man or materials, and thus finally bring success from apparent failure.

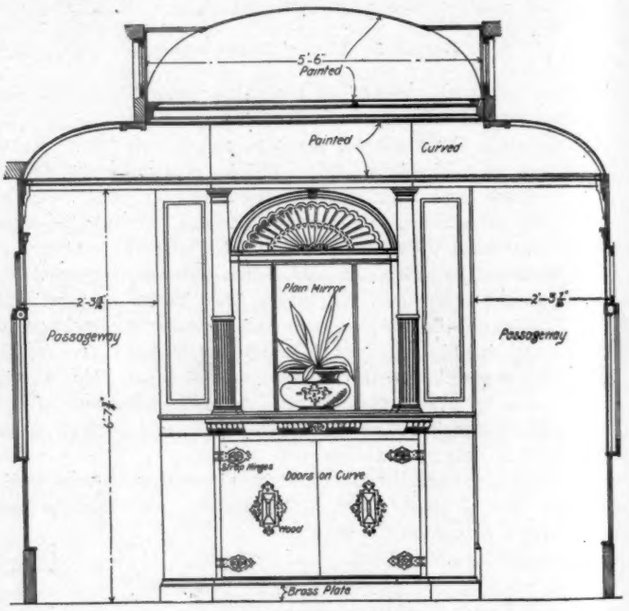
After thus inspiring his audience with the dignity of the demands which would be made upon them, Mr. Herr described in detail the organization of a large manufacturing establishment, showing the purpose of each department and the dependence of one on the other. He traced the movements which are made between the receipt of an order and the shipment of the machine ordered. In conclusion he said, "Be kind and considerate to your fellows, courteous and obedient to those in authority, and strive always to do a little more than is expected of you, and I can safely promise that there will, in your case, be no such word as fail."

NEW DINING CARS.

Chicago, Burlington & Quincy Railroad.

Through the courtesy of Mr. F. A. Delano, Superintendent of Motive Power of the Chicago, Burlington & Quincy Railroad, we have received the floor plan and drawings of the interior finish of some exceedingly interesting dining cars just completed for that road at the Pullman shops. Special attention was given to the interior decorations and finish to secure a genuine artistic effect, and the result is very pleasing. It is more striking because of being the first instance of real artistic taste in a car interior that has ever come to the writer's notice, and we shall be mistaken if it does not have an important effect upon future practice. There is nothing about the interior of the car that would look out of place in a fine house. The design is quiet and simple, there is practically no ornamentation, except on the buffet and niche. The whole scheme is an expression of quiet, elegant taste.

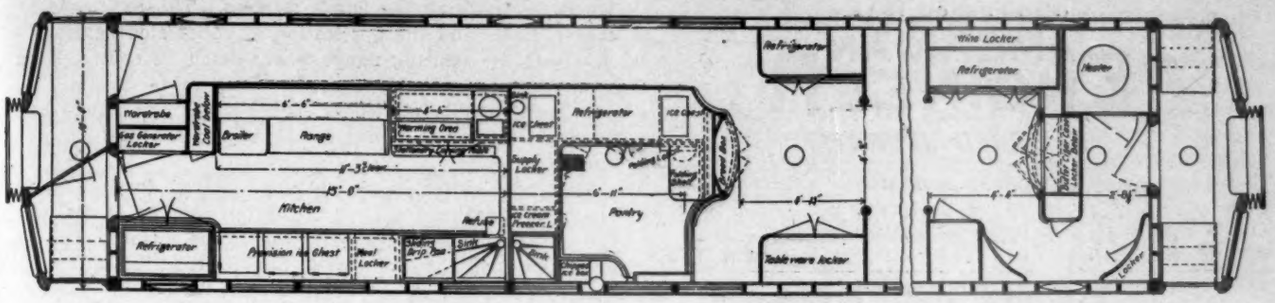
The floor plan shows the general arrangement, in which it will be noted that the kitchen is large and that the end opposite the kitchen is arranged with a buffet, directly opposite the



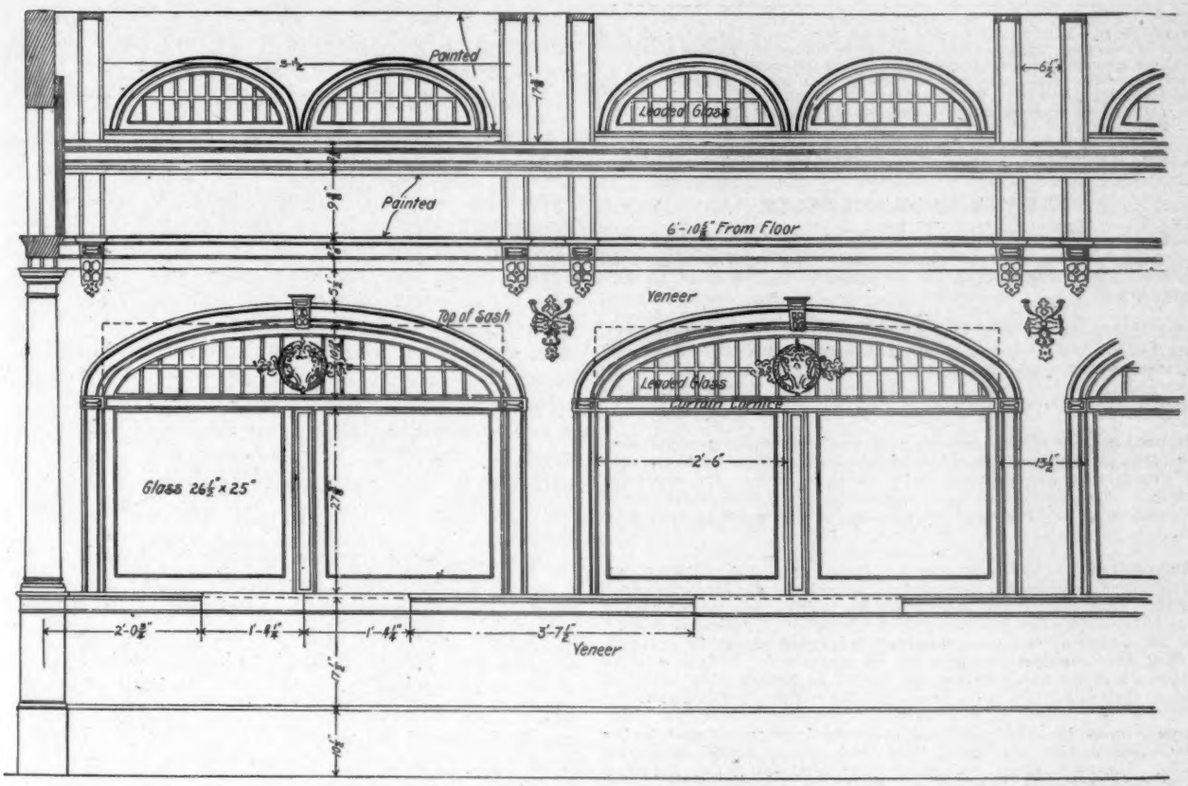
Elevation of Niche.

door. The sides of the dining room are wainscoted to a point above the large windows in very dark, almost black, Flemish oak. Above the high wainscoting and across under the roof the headlining is a strong sunflower yellow. The oak is finished without polish and is exceedingly handsome. The headlining is entirely devoid of ornamentation and the color effect with crimson window shades and carpets is exceedingly tasteful. The coat hooks and other metallic furnishings are of yellow brass. In order to break the long lines of the interior Flemish oak beams are carried up the sides and across the ceiling, as indicated in the view of the side finish. There are no curtains, merely plain shades, and above the top lines of the shades the windows are completed with stained glass in harmonizing colors. A description of the effect is difficult.

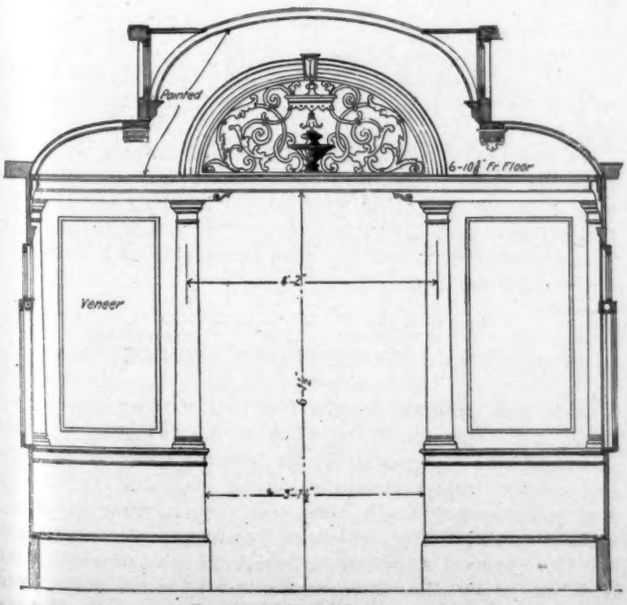
The cars are 70 ft. long, 10 ft. 4 ins. wide, and the dining room is 32 ft. 2 ins. long. There are 10 tables, 5 with 4 seats each on one side, and 5 with 2 tables each on the other. The tables are placed at 6 ft. 4 in. centers. The kitchen end of the dining room is completed by a niche, an elevation of which is shown in one of the drawings. At the other end is a sideboard, which is also illustrated. There are five of these cars now building and we hope to illustrate them further by photographs next month.



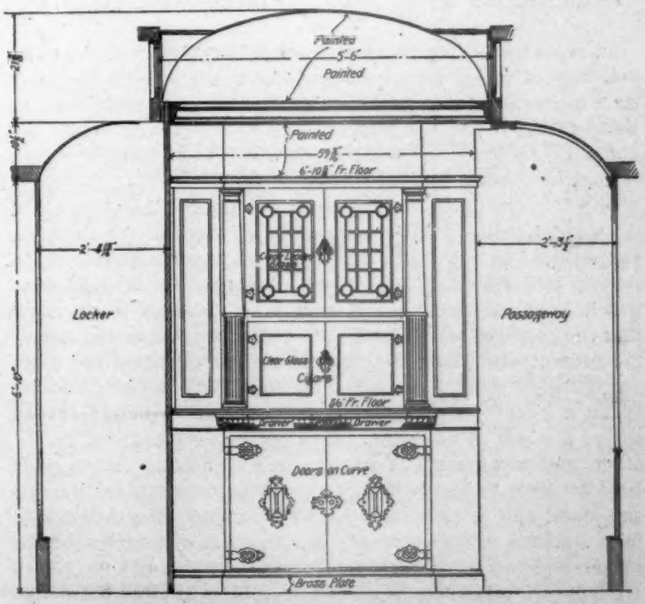
Plan of End Portions of Dining Car.



Side Finish in Dining Room.



Bulkhead Partition.



Sideboard Elevation.

New Dining Cars, Chicago, Burlington & Quincy Railroad.

(Established 1832

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Contributions.—*Articles relating to railway rolling stock construction and management and kindred topics, by those who are practically acquainted with these subjects, are specially desired. Also early notices of official changes, and additions of new equipment for the road or the shop, by purchase or construction.*

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THE CHILLED WHEEL—HAS IT REACHED ITS LIMIT?

An exceedingly important question is brought forward by the breakage of wheel flanges under freight cars of 50 tons capacity. In our February number the situation was mentioned as serious, and it has not improved since that time. While the difficulty seems to be greatest on roads with severe grades it does not appear to be confined to such.

One of three things is necessary: to improve the strength of the present chilled cast-iron wheel by changes in the chemical proportions, to substitute for iron a stronger material or to relieve the wheels of the destructive stresses or influences which cause the trouble. It would not be wise to say now that the cast-iron wheel for 50-ton cars must go, but that under the present conditions as found in our investigation the present cast-iron wheel has reached its limit there can be no doubt. When a piece of a flange measuring 26 ins. in length breaks out of a wheel in one case, the entire flange breaks off in another, and many cases of fracture occur, the statements made here are seen to be justified. Our inquiry covers three important roads, and in each case the motive power officers speak of it as a source of great anxiety which is not allayed by the assurances of the makers of cast-iron wheels.

It appears that there is no opportunity to enlarge the flange because it is out of the question to change the throat space in the track frogs. There is no doubt of the value of swing motion trucks in reducing the flange stresses. The improvement of center plates and the application of roller side bearings will also help by reducing flange wear, which, of course, leads to weakness and probably causes heating of the metal. There has been trouble elsewhere, but because the flange cannot be made thicker this part is the key to the cast-iron wheel situation.

The troublesome breakages are believed to develop from cracks originating inside of the metal, near or at the root of the chilled portion and working out to the surface. The fractures are usually, but not always, blue in color, indicating oxidation by heat, and except when inspected while the wheels are hot from a recent brake application the cracks when they come to the surface are difficult to find. This blue appearance seems to indicate that high temperature is a factor. This view is supported by the experience of one road where the effect of a heavy mountain grade is clearly noticeable. But it is not impossible that in some cases this may be traced to foundry practice.

There may be two causes for this heating. It may come from the brake shoes and it may come from flange friction and perhaps both. It has been noted that many breakages occur on flange-worn wheels, though this is not always the case. One theory is that the trouble may be overcome by improving the center plates and providing roller side bearings to make the trucks curve easily. This involves radical changes in the construction of a large number of trucks. This should be done anyway, but it is doubtful whether it will suffice. There seems to be a good basis for the theory of a flowing of the metal of the wheel due to a combination of load and stress from side thrusts which tend to cause the cracks and their development into fractures. It is, however, a curious fact that the only way in which these flange breakages have been successfully imitated experimentally has been by the application of heat.

In examining a fracture through the tread and flange of a cast-iron wheel one is impressed with the fact that there is very little gray metal at the vital part of the flange and as the chilled metal may be pulverized with a hammer it is clear that the gray iron is all that is to be depended on for strength. It seems reasonable to believe that the limit of strength was nearly reached in 40-ton cars and that the 50-ton car has merely developed the weakest spot, the flange. Three-quarters of an inch of gray iron in a flange does not appear to be enough. In the absence of experience with steel-tired wheels in freight service no one can say what they will do, but a large scale experiment will soon be tried to settle this. There can be no doubt that the steel-tired wheel will be thoroughly tried, and the question will rest simply on a basis of cost and endurance. If steel-tired wheels are used we may be sure that precautions will be taken to keep down the flange wear because of their high cost.

We desire to be perfectly fair. If the cast-iron wheel can meet the demand it is very important to know it. If not it must give place to other material. It is significant that the best authorities on the subject of cast iron wheels are the most anxious about them and the most thoroughly at a loss as to how to improve them.

GAS ANALYSIS APPLIED TO LOCOMOTIVES.

Grate area sufficient for the fuel is now thoroughly appreciated, but every bit of testimony to the advantage of large enough grates is acceptable. Mr. Bement supports the general opinion from examination of the gases and records his observations elsewhere in this issue. There are many small grates in use, however, which, as he says, cannot be changed, and these present a problem in which all are interested, viz.: How may combustion upon small grates be improved? Firing lightly and frequently has had strong advocates for a long time, and to the benefits already accorded to this practice Mr.

Bement adds the important one of economy in operation. To many his observations will not appear to be novel, but the combination of frequent and light firing with frequent shaking of the grate as a method of improving the operation of the locomotive with a small grate seems to be a very important suggestion.

Mr. Bement's tests were carried out on one of the western roads and it is surprising to have him tell us that with a grate area of 30 sq. ft. more coal could be burned than could be supplied by one fireman and yet at the end of the division the fire was in condition for the engine to take a train back at once. As a result of the light firing and frequent shaking of the grates the exhaust nozzles were at once enlarged. We shall have occasion to refer to Mr. Bement's methods later in connection with other important work, but it may be well to remark here that the study of furnace combustion by means of the analysis of the waste gases is a very important development at the present time. There is nothing new or mysterious about it. The apparatus used has been familiar to chemists for many years. It is very simple, easily manipulated and in fact requires but one observer. The determinations made are the proportion of oxygen, carbonic acid and carbonic oxide. With these the furnace action is clearly revealed and the remedy for wrong conditions may be easily applied or, at least, the conditions may usually be improved. It is extremely important that locomotives with small grates should be given the most careful consideration because they will for a long time outnumber those with wide grates.

The most important part of Mr. Bement's work thus far appears to be the fact that a great deal depends upon air supply. The improvement of very large engines having small grates seems to lie in the opening of the fire door to an extent to be indicated by the gas analysis. In some cases metallurgical furnaces have been operated with the door open all the time and with blast furnace boilers it is an advantage in some cases, when the gas comes in large volumes very rich in CO, to open the doors wide while such a condition exists.

We are told of a large plant in Indiana burning natural gas where the capacity of the mains to supply gas was exhausted and the boilers were thought to be forced to the limit of their capacity. By examining the gases it was found that more of the heat was employed in heating air which went up the chimney without accomplishing anything than was used in heating the water. This discovery led to shutting down half of the boiler plant, the remaining half then being sufficient. This was the effect of a large excess of air.

A tendency toward overdoing in the air supply should be guarded against in connection with the introduction of larger grates and this is a good reason for welcoming heartily the gas analysis method of studying locomotive combustion. Its appearance is opportune.

CORRESPONDENCE.

LOCOMOTIVE CLASSIFICATION, LEHIGH VALLEY RAILROAD.

To the Editor:

I have noticed lately several propositions for a system of classifying the different types of locomotives. I beg leave to submit another. It is of the following form:

$$\frac{10}{4}\ \frac{C}{74}\ \frac{20}{26}\ W.$$

At first sight this appears very complicated and long. On the other hand, familiarity with the key renders its complexity of form unobjectionable, and as it really conveys a great deal of information beyond defining the type, its use and the memorizing of the key are worth the effort.

The first part, or first fraction, denotes the total number of wheels, and the number of wheels in the leading truck—the numerator indicating the total number of wheels under the engine; the denominator the number of wheels under the leading truck. A yard engine having no leading truck would omit the denominator.

The second part, or second fraction, indicates two things—the numerator, the number of pairs of coupled or driving wheels; and the denominator, the diameter of the wheel centers in inches. The letters representing the number of pairs of coupled wheels may be selected arbitrarily. Those given below represent the practice of our road and at least one locomotive builder.

B - 1 pair of coupled wheels,
C - 2 pairs of coupled wheels,
D - 3 pairs of coupled wheels,
E - 4 pairs of coupled wheels,
F - 5 pairs of coupled wheels,
G - 6 pairs of coupled wheels.

The third part, or third fraction, also represents two things; the numerator, the diameter (or diameters in a compound) of cylinders in inches; the denominator, the length of stroke in inches.

The fourth part, or letter, represents the type of firebox.

I - a narrow box between the frames,

T - a narrow box on top of the frames,

C - a compromise box, exceeding the width of frames and above the wheels at this point, whether driving or trailing, and up to a width of 72 ins. W is a wide box above the wheels, and over 72 ins. wide.

The classification used above for illustration indicates what is at present termed an Atlantic Type engine with a four-wheel leading truck, 74-in. wheel centers, a 20 by 26-in. cylinder, and a firebox over 72 ins. wide.

The Pennsylvania Railroad engine, class E-1, becomes class $\frac{10}{4}\ \frac{C}{74}\ \frac{20\frac{1}{2}}{26}\ W.$

The N. Y. C. & H. R. Atlantic type becomes $\frac{10}{4}\ \frac{C}{72}\ \frac{21}{26}\ W.$

The C. & N. W. Atlantic type becomes $\frac{10}{4}\ \frac{C}{74}\ \frac{20}{26}\ C.$

The B. & O. Compound Atlantic type becomes $\frac{10}{4}\ \frac{C}{72}\ \frac{15\ \&\ 25}{30}\ C.$

The C., B. & Q. Prairie type becomes $\frac{10}{2}\ \frac{D}{58}\ \frac{19}{24}\ W.$

Such a system would at a glance not only define the type of engine, but by giving its leading dimensions, give some idea of its size and capacity. A classification plate carrying the class of the engine, and located in some accessible position, as regards observation, would be of value to both the transportation and motive power departments.

F. F. Gaines,
Mechanical Engineer, Lehigh Valley R. R.

THE FATE OF A DRAFTSMAN.

To the Editor:

I have read with a good deal of interest in the March number of the American Engineer your article entitled "The Fate of a Draftsman," and take the liberty of adding a few remarks on a subject which I know is of keen interest to the large number of draftsmen employed by railroad companies.

From the nature of drawing room work it is but following the natural order of things that good men pass through this office. In common with many other qualities the successful motive power man of to-day must possess an abundance of life and energy. A man full of life and energy is not the one to stand for more than four or five years the intensely tedious and closely confining work in the drawing room. Because good men for the reason just stated cannot be expected to remain permanently in this office, the solution of this difficulty seems to me this: Every superintendent of motive power should bring this sub-department in close touch with all other branches of his department, and make it a necessary channel for all young men in his department who are ambitious for advancement. The salary of the mechanical engineer or chief draftsman in charge of the drawing room should be amply sufficient to secure and retain for a number of years the services of a man of mechanical and executive ability who may put and keep the drawing room in the highest state of efficiency and usefulness.

It is indeed to be regretted that railroad drawing rooms are

so conducted that good men hesitate to enter. The education of every mechanical engineer and motive power officer is to quite a degree incomplete until he has spent some time over the drawing table in an up-to-date drawing room, and a good man need not hesitate to enter one, because, if a good man, his time need not be longer here than is necessary to gain valuable information.

The drawing room is to a great extent an educator for the future executive officer. In what other office can be better learned the importance of system, the ability to develop and maintain standards and the great economy resulting therefrom? In what office is the habit of self-reliance and self-confidence better developed, where the practice of absolute accuracy is an every-day necessity? These are all points and qualities the appreciation of which and the possession of which are necessary to the successful motive power official.

From my own experience I would not care to have the services of a draftsman who showed no dislike to the idea of continuing as a draftsman indefinitely. There is indeed no sympathy needed for the draftsman who complains because there is no outlet for him. If there is not where he is, let him seek elsewhere. The "fate of a draftsman" is one of his own making, and viewed in that light his fate is no "fate," but his own fault.

A. H. Weston.

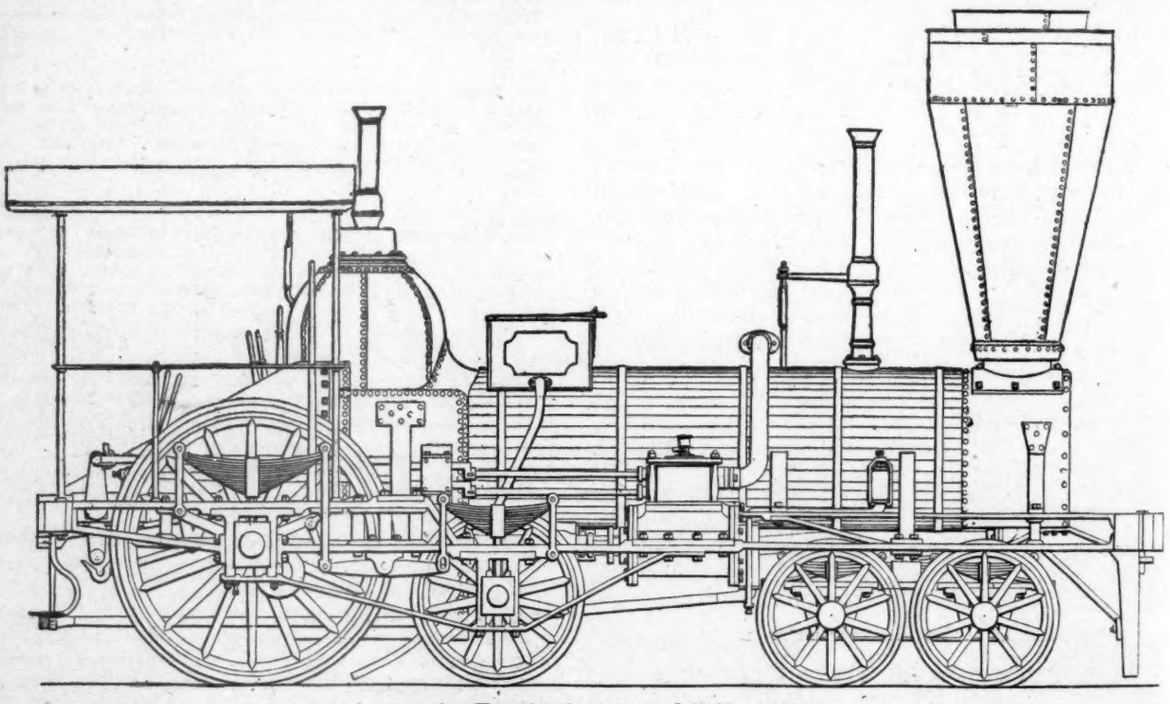
To the Editor:

An expression of my thoughts on the editorial, "The Fate of a Draftsman," which appeared in the March issue of the American Engineer, I hope may interest you. That the drafting office is not a field for promotion, except to a limited extent, is quite true. This, I believe, is in a large measure due to the fact that a very large proportion of the mechanical draftsmen have taken to drafting mainly because of the desire for genteel work. Of the large number of draftsmen of my acquaintance I knew of only two who have completed a shop apprenticeship and of three others who have had about eighteen months' experience in the shop. From this it is not surprising that superintendents and master mechanics do not look to the drafting office for their shop foremen. If the accepted way to the drafting office was through a shop apprenticeship there is hardly any doubt but that a large majority of the various shop foremen would be drafting office graduates. The fear of becoming stranded in the drawing office or the certainty of delayed promotion, or both, I know have caused some shop-trained young men to forego a much desired drawing office training. And I believe these causes account for the lack of shop men in the drawing office generally. The first master mechanic who put me to work as an apprentice in a railroad shop met me several years after in a drawing office; he wanted to know why I remained in the drawing office and threw away my chances for promotion in the shop.

The promotion of the right young man from the shop will certainly be delayed if he enters the drawing office. This is not to be regretted, as the experience acquired during the delay will be the most desirable for future work. While the fear of becoming "sidetracked" is not groundless, this should not deter any ambitious mechanic from entering the drawing office, for, if he is the right sort of young man, he will have no trouble in out-shining his present-day fellow draftsmen sufficiently to be seen by those in authority. It is then that he will be selected from among the others to carry out those jobs that are outside the routine work of the office. These jobs usually cause him to take to the shop or go out on the road. Then he will have the much desired opportunity to show his ability and make himself known.

When I was in the general drawing office there was no difficulty about getting up a little discussion on most any subject during the usual noon hour debate. Then would have been the time to get up a discussion on your editorial. Since I have been taken out of the general drawing office I can't, conveniently for all, arrange to get up a discussion. Individual comments from a few of the draftsmen were that the editorial was all right, that it should be enlarged and framed, then hung up in the offices of a few of the minor officials, who seem to think that the drawing office is not a necessary adjunct to the success of the plant.

Draftsman.



Locomotive Traction Increaser of 52 Years Ago.

TRACTION INCREASERS.

To the Editor:

Referring to your remarks, pages 82 and 87 of the March issue, relating to locomotive traction increasers, M. W. Baldwin, of Philadelphia, the founder of the Baldwin Locomotive Works, about the year 1848 or 1849 invented and patented a traction increaser which was part of the design of an express passenger engine with single pair of drivers and leading pair of carrying wheels. This device consisted of a toggle joint with a long lever projecting up into the cab. This toggle joint was bolted to the frame and connected with the back end of the equalizer and by pulling the lever back part of the weight on the carrying wheels could be thrown on the drivers. The arrangement is shown very plainly in the line illustration herewith, which was issued by M. W. Baldwin to show the design of this class of locomotive. Four engines were built from these plans.

one named Blair and one Mifflin, went to the Pennsylvania Railroad, then about being opened for business. One was sold to the Hudson River Railroad and one to the Vermont Central Railroad. It was reported that the Pennsylvania rebuilt the two they had and the other two were reported wrecked. The plan did not appear to have been a success, no more engines having been built from it. It is surprising that after 52 years' rest this old device, or a modification of it, should come to the front.

James M. Boon.

Chicago, March 14th, 1901.

COMBINATION CYLINDER SADDLE AND FRAME BRACE.

To the Editor:

Within the past few years it has been necessary to materially increase the height of cylinder saddles, due principally to extending fireboxes over the frames and allowing sufficient height between the top of the grate and the bottom flue. With the arrangement of firebox over the frames and between the wheels, a better opportunity is afforded to secure the boiler to the frame than in the present wide firebox engines or Wootten boilers. In the first case mentioned the firebox mud ring resting on top of the frame gives ample surface for furnace bearers, allowing for expansion, and at the same time the force tending to move the boiler longitudinally due to sudden starting, stopping and bumping, is much more restricted, owing to the friction between the parts, than in the method of supporting Wootten or wide firebox boilers by plates or links. This latter arrangement compels the cylinder saddle to absorb all strains developed by the mass of metal and the water in the boiler suddenly put in motion or brought to rest. That these strains are more severe with the Wootten than the ordinary firebox is attested by the fact that cylinders on such locomotives are at least 10 per cent. heavier than the same size cylinder for a bituminous coal burning locomotive, with the firebox between the frames.

An effort to provide for the strain on the saddle has been made by applying outside ribs, increased thickness of walls and diagonal longitudinal braces in the form of smokebox braces, extending forward and backward from center of cylinder saddles. These all tend to place an excessive weight where it is not wanted, and have not proved an efficient means to provent movement of the parts. The large boilers and large wheels have both contributed toward making this an exceedingly difficult problem to solve. It has, however, been accomplished in some later designs by an increased length of cylinder saddles, but this is objectionable in that it lengthens the engine or shortens the flues, and at the same time greatly increases the weight of cylinders.

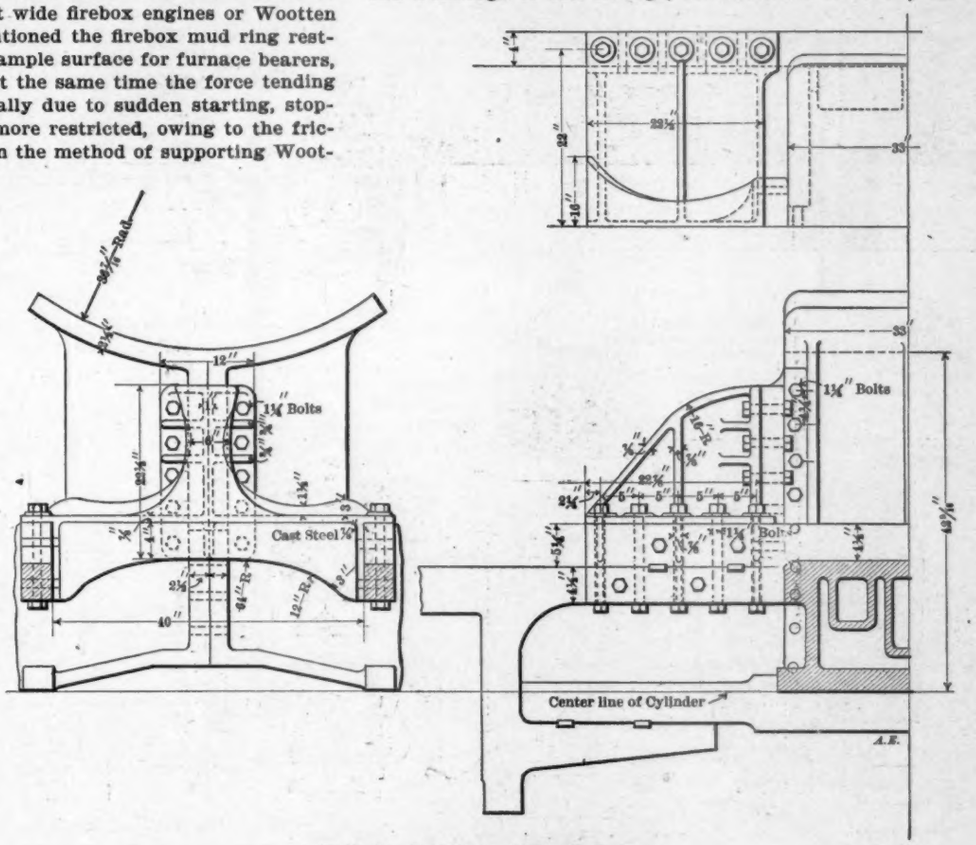
Knowing the value of a frame cross brace immediately in front of or behind the cylinder for absorbing transverse strains, we applied the brace shown in the engraving, which, by an addition of very little weight, does the double duty of frame cross brace and cylinder saddle support. The amount of metal required in a brace of this kind, compared with the amount of metal necessary to produce the same rigidity, distributed elsewhere, is small. This design, of course, is open to several changes to suit the different conditions imposed by the different types of locomotives. Two upright members can be used at the outer edges of the frame, or this brace can be made a part of the center-pin guide in front of the cylinders, or used on exceptionally large locomotives, both forward and back of the cylinder saddle.

The object, however, is to brace directly to the cylinder saddle above the frame connecting it in such a manner that the strains heretofore passing through the saddle may be transmitted to the frames through other means than through the saddle itself; this arrangement allowing the cylinder to be made with the ordinary staying. The manner of fastening the brace at the frame splice makes a rigid piece of work, and will obviate the necessity of using a frame filling piece at this point.

With this form of brace we get the maximum strength and minimum amount of metal. The casting weighs 870 lbs., and we have saved about 2,000 lbs. of cast iron in the cylinders to which this has been applied, effecting a saving in weight and adding to the strength of the machine.

F. F. Reese,
Chief Draftsman, Dickson Locomotive Works.

March 14, 1901.



Cylinder Saddle and Frame Brace.
Dickson Locomotive Works.

Mr. Onward Bates, Engineer and Superintendent of Bridges and Buildings of the Chicago, Milwaukee & St. Paul, has resigned to become a member of the firm of Bates & Rogers, Civil Engineers and Contractors, with office in the Manhattan Building, Chicago. The experience through which Mr. Bates had passed prior to his connection with the Chicago, Milwaukee & St. Paul was varied and extensive, giving him the foundation upon which he was able to build the splendid record that he has during the past 13 years with the Chicago, Milwaukee & St. Paul. In this period he has built more than 11 miles of iron and steel bridges; and culverts which made it possible to replace 44 miles of wooden bridges with earth embankments. During Mr. Bates' connection with this road it has never lost the life of a passenger through any fault of the bridges or the bridge department. Besides being a most careful designer, he was a successful organizer. Mr. Bates holds an honorary degree of Civil Engineer from the University of Wisconsin, and is a member of the American Society of Civil Engineers, Western Society of Engineers, Institution of Civil Engineers, American Railway Engineering and Maintenance of Way Association and other technical societies.

FRICTION DRAFT GEAR.

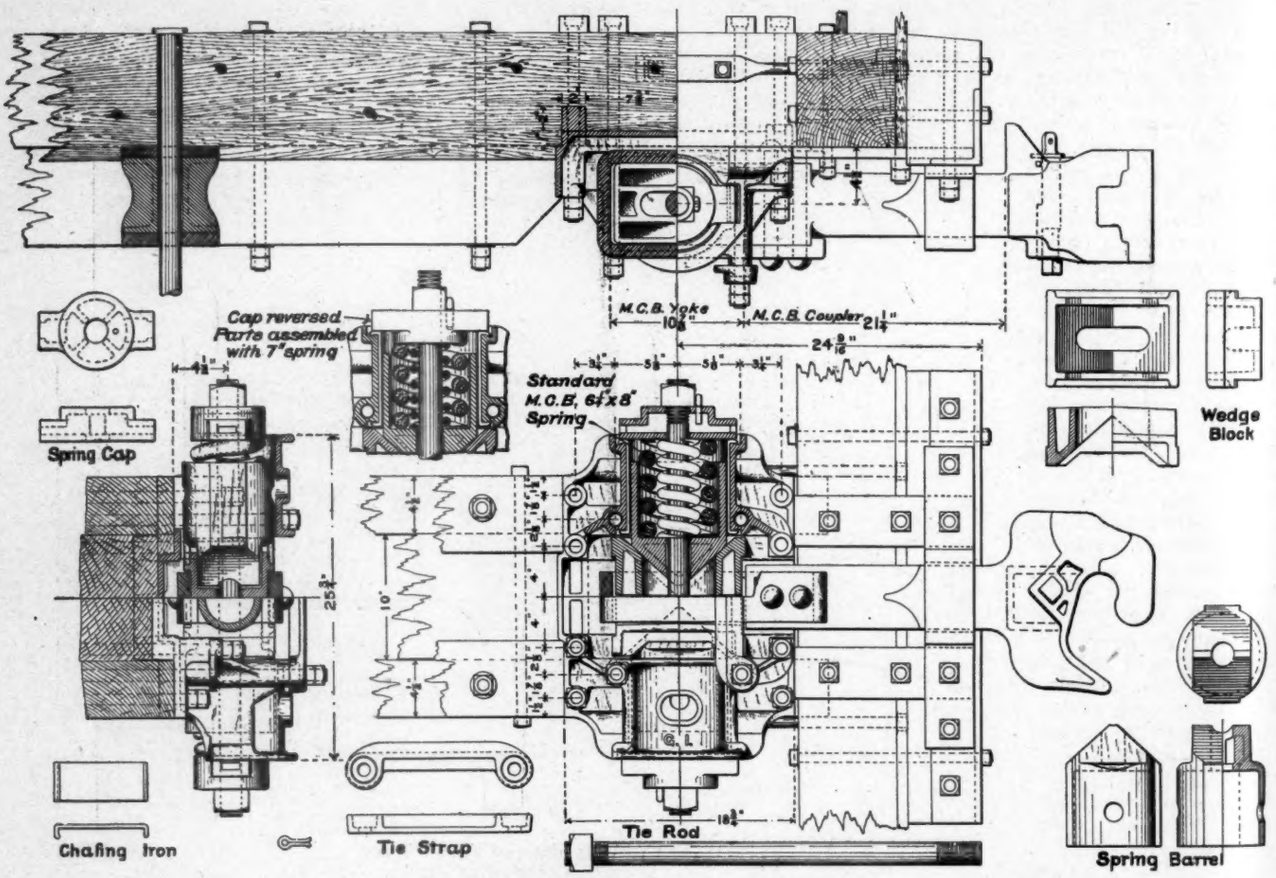
The Standard Coupler Company.

Mr. H. H. Sessions, of the Standard Coupler Company, has embodied his experience and knowledge of car matters in the design illustrated by these engravings, and while experience, and that only, can prove a device of this kind the requirements sought by the designer seem to be met by this device. Instead of increasing the effect of recoil, it actually reduces it below that of ordinary spring gear. This is known as the Sessions-Standard Draft Gear.

The essentials of this gear are a malleable iron housing, a pair of malleable iron wedge blocks, a pair of wedge-ended spring barrels, two standard draft springs, two spring caps, a tie rod and the standard M. C. B. coupler and yoke. These parts are clearly indicated in the drawing, and a glance at the inverted plan showing the device in half section makes the application plain. By either buffing or pulling the yoke moves the wedge blocks and the inclined surfaces compress the springs within the spring barrels. The springs return the wedge blocks to their normal positions, and this without shock or recoil to the coupler, because any tendency for the coupler to pass its normal position is resisted by the spring acting on the inclined surfaces.

It is obvious that a broken spring does not prevent the action of the device, though it reduces its capacity to that of the remaining spring. In case the castings break, the 1¾-in. tie rod remains as a safeguard against pulling the coupler out and an idea of the care of the designer to meet the conditions of present practice is given in connection with the spring cap, which will accommodate either a 7 or an 8-in. spring, according to the way it is turned. The whole gear may be dismantled by the removal of a spring cotter and a single nut on one end of the tie rod. This is so simple that it should require only a few minutes to make any necessary renewals or repairs. To provide for wear of the spring barrels in the housings strips of steel are inserted against which the flat portions of the barrels bear. This was done to remove all wear from the housings and render that part of the gear a permanent portion of the car structure, which will never need to be removed except in case of damage in a wreck. In buying this device the railroads will furnish only the springs, which are kept in stock in every railroad storehouse.

This arrangement does not require draft timbers, because the housing casting is bolted to the center sills and to a filling block fitted between those sills, and extending about 4 ft. back of the transom. Additional security is provided by a thrust block between the inside of the housing and the bolster and by deep lugs on the housing casting which are let into the center sills and filling block. To show the effect of the stresses produced by a drop test with reference to the recoil we have been supplied with a sketch by which is shown the recoil of a weight falling on a pair of standard draft springs laid on the anvil side by side and that of the same weight acting on the same springs through the friction draft gear. This weight was sufficient to close the springs in the first test at 7 ft. The first test gave a number of vibrations, of which four are shown, whereas the test with the friction device gave but one recoil movement. The amplitude of these movements is indicated in the diagram. While the drop on a twin spring arrangement exhausted the springs with a 2-in. movement, the same weight falling an equal height on the friction gear caused a movement of but ¾ in. out of a possible movement of 1⅞ ins. The parts have easy fits and in the normal condition the springs press the wedge-shaped ends of the spring barrels into the wedge blocks and are always ready for action without any lost motion to produce shocks. Angles of 40 degs. were determined by experiment as the most satisfactory.



The Sessions Standard Friction Draft Gear.

While the development of this gear has been conservative, it has been applied to 300 cars on the Seaboard Air Line and is now being applied to a number of cars on the New York, New Haven & Hartford Railroad. We shall watch the progress of the device with interest and acquaint our readers with the results of tests which are soon to be made on the latter road. Drop tests made at the shops of the manufacturers have shown the capacity with standard springs to be about 120,000 lbs., or more than three times the capacity of the same springs when used in the ordinary way between followers, and tests made on an "Olsen" testing machine showed a final elastic resistance of more than four times the resistance of an ordinary twin spring arrangement. We append the following statement of the case by the best authority we know on car construction and operation. It presents the view of those who have developed this draft gear.

"When the average box car weighed about 22,000 to 24,000 lbs., and had a rated capacity of about 30,000 lbs. of load, single draft springs were used—that is to say, one spring to each drawbar. These springs were from 6 to 7 ins. high and from 5½ to 6 ins. outside diameter, and their ultimate yielding resistance from 12,000 to 17,000 lbs. With locomotives having a tractive power of from 20,000 to 30,000 lbs. it is evident that in starting a train of, say, 30 loaded cars, the draft springs in the first half of the train would be exhausted, or 'bottomed,' unless some mechanical means were employed to prevent it. Several draft spring pockets were designed with limit stops for the follower plates, which prevented 'bottoming' the springs, by limiting the travel of the follower plates to something less than the compression limit of the spring. The effect of this was to impact uncushioned and destructive impact to the car body, frequently breaking the follower plates, pockets and draft timbers. As locomotives were increased in their tractive power to haul longer trains of heavier cars, the destruction of draft timbers, and, in fact, the whole draft rigging, was so much increased that greater cushioned resistance became desirable. As the distance between the draft timbers would not readily admit of two springs being used side by side, to give greater spring resistance, many ingenious devices were designed to use two springs tandem, and in multiple, thus doubling the spring power of the single springs rigging. While this seemed the logical solution of the trouble, it was found that while the impact, or 'dead' blows, were largely diminished, the reflex action of such powerful springs was, in a long train, fully as destructive as was the impact when the single spring was used. This will be appreciated when watching a long, heavily loaded train, with the locomotive trying to start it. Several of the cars at various parts of the train will be in the reflex motion while the others, with the locomotive, will be advancing. The increased spring power must necessarily have this effect. Yet it is almost certain that in the heavier cars, or trains, the single spring draft rigging would not be adequate to the service. Even with tandem springs of a combined power of 38,000 lbs. many of the cars in the forward part of a train, with a locomotive of the later types, would have their draft springs exhausted, yet the increased power of these springs would give a reflex action, or recoil, to a destructive degree. So it seems that while the tandem springs in this latter action are too strong, they are not strong enough in their cushioned resistance. It would appear that another principle must be employed to attain the desired result. We desire a yielding resistance considerably greater than the combined strength of the two springs used in the tandem devices, but without the quick recoil due to direct spring pressure, but with a retarded or restrained action of the springs in returning to their normal condition."

Diagram showing limit of elastic resistance and recoil in drop test of Sessions-Standard Friction Draft Gear, as compared with an ordinary spring arrangement. Two standard M. C. B. springs (6¼ x 8 of 19,000 lbs. capacity) used in both cases. Height of broken line shows height of drop and solid lines show recoil of drop.

PERSONALS.

Mr. M. M. McCallister, Assistant Foreman Boilermaker of the Richmond Locomotive Works, has resigned, to accept the position of Foreman Boilermaker of the Lake Shore & Michigan Southern at Cleveland, Ohio.

Mr. James Collinson, Master Mechanic of the Gulf, Colorado & Santa Fe, at Cleburne, Tex., has been appointed Assistant Superintendent of Machinery of the Atchison, and is succeeded by Mr. Thomas Paxton, Master Mechanic of the Eastern division of that road.

Mr. Samuel Watson has been appointed Master Mechanic of the middle division of the New York Central & Hudson River, with headquarters at West Albany.

Mr. W. J. Gillingham, Signal Engineer of the Illinois Central, has resigned to take the position of General Western Agent of the Hall Signal Company, to succeed Mr. W. W. Salmon.

Mr. Ira C. Hubbell, for a number of years Purchasing Agent of the Kansas City, Pittsburg & Gulf and its successor, the Kansas City Southern, has been appointed Purchasing Agent of the Union Terminal Railway Company, of Sioux City. Mr. Hubbell will have his headquarters in the Fisher Building, Chicago.

Mr. E. Belknap has been appointed General Purchasing Agent of the Seaboard Air Line, with headquarters at Portsmouth, Va., in place of Mr. O. D. Ball.

Mr. H. D. Taylor who, for the past two years has been connected with the Calumet & Hecla Mining Company, has been appointed Superintendent of Motive Power of the Lehigh Valley, with headquarters at South Bethlehem, Pa., to succeed Mr. Samuel Higgins. Mr. Taylor was formerly in the service of the Lehigh Valley as Mechanical Engineer and as Master Mechanic of the shops at Wilkesbarre.

Mr. Samuel Higgins, Superintendent of Motive Power of the Lehigh Valley, has resigned to go to the Union Pacific in the same capacity, succeeding Mr. Joseph H. McConnell. Mr. Higgins' railway service began in 1881, when he entered the shops of the New York, Lake Erie & Western as machinist apprentice. He was in continual service with that road for 20 years, working through the responsible positions of Assistant Foreman, General Foreman, Assistant Engineer Motive Power Department, Master Mechanic and Assistant Superintendent of Motive Power. The latter position he left in 1893 to go to the Lehigh Valley.

"MAMOLITH" CARBON PAINT.

How to protect the metallic structures which have become so important in recent years is a vital question upon which the best opinions have been divided. One may consult engineering literature for the past ten years without satisfaction, because of the variety of opinions among those who have given the subject the best attention, and when attention was called to this new paint the subject was thoroughly investigated personally by a member of the staff of this journal for the purpose of presenting an intelligent statement concerning it.

"Mamolith" is the name given in 1895 to a semi-petrified noncorrosive vegetable substance found in a locality in Arkansas believed to be the only deposit of the substance in its purity. It contains in the natural state about 85 per cent. of carbon, is free from grit and is easily reduced to powder as fine as the finest lampblack. In its development into a paint material six years have been spent in investigation and experiment, this being done very quietly and systematically until those interested were sure of their ground. Seldom, if ever before, has a new pigment been so carefully exploited and the results appear in every way promising.

Five years ago little was heard about other than lead and iron oxide paints for metal work. Opinion was vigorously divided between these pigments and much was written on the subject. Since then the carbon paints have taken prominence and they are now preferred by many for important structural work where the metal parts are permanently concealed as well as for exposed surfaces.

Among painters lampblack, ground in pure linseed oil, has been a standard of comparison, because of its "body" and durability. This, however, is expensive, and the great coloring capacity of lampblack limits its use to very dark or black colors. To use enough lampblack to secure the desired "body" involves a necessarily dark color, and this difficulty led to the examination of the carbon described here as a pigment. It was believed to offer properties of "body" equal to those of lampblack and was at the same time so weak in coloring strength that a large amount could be used with relatively light colors. On the other hand, for a protective coating for metallic structures the well-known characteristics of lampblack were expected. The tests investigated by our representative appear to indicate that these condition are realized, although further experience seems to be needed before it can be said to be unquestionably superior to the best lampblack. There is no hesitation, however, in the statement that after two years of severe exposure it is in better condition than the best lampblack and linseed oil paint exposed under exactly similar conditions. To men experienced with paints this statement will be understood as an important one.

The pigment has reached beyond the experimental stage. It is now being extensively used for large roofs in an industrial establishment in Poplar Bluff, Mo., on a large order for large capacity cars now building for the "Big Four" by the American Car and Foundry Company, and has been used on a number of large Western railroads and by the Standard Oil Co. The paint department of this company during the past 18 months has made exhaustive tests of paints which they have manufactured from this material, all of which they have found to be entirely satisfactory. This company is probably the largest user of paint such as can be produced from Momolith Carbon, and it is now being used in large quantities for tanks, buildings and cars. It is giving good results at their various works as a preservative paint. The Brooklyn Cooperage Company use it exclusively for buildings, docks, stacks and tanks at the following places: Brooklyn, N. Y.; Poplar Bluff, Mo.; Kane, Pa.; Oswayo, Pa.; Cross Fork, Pa.; and St. Mary's. Pa. It has been very satisfactory in all of these applications and such a large scale endorsement is important evidence of the qualities of the pigment.

The roofs in Poplar Bluff, Mo., referred to, are those of the H. D. Williams Cooperage Company. They are exposed to exceptionally trying conditions. In the manufacture of barrels of oak the steaming of the staves produces a moist atmosphere containing tannic acid, which is exceedingly destructive to metallic roofs. Formerly two new roofs were required every three years, but the application of this paint has preserved them in good condition in some cases for six years. Upon scraping this paint with a knife it was found to be elastic, with considerable life remaining. A boiler house roof was found in excellent condition, and the paint tough and elastic after three years' exposure to steam and hot air, the roof being only about 6 ft. above the boiler shells. It was subjected to steam and sulphur fumes. These were cases of paints mixed dry and not ground in oil; they were, furthermore, single, but heavy coats. A very severe test of this paint was made last year in an exposure of 11 months upon the circulating piping in the brine tanks at the plant of the Poplar Bluff Ice Company. The pipes were sometimes in the brine and sometimes in the air, and always at low temperatures. At the end of that time the coils were changed, and the metal was found to be thoroughly protected, the paint being elastic and good. The experience in this damp climate in southern Missouri, and particularly in the cooperage plant, is nothing short of remarkable. The paint on these walls was all mixed and applied by unskilled labor, and it is known that benzine was freely used in the mixing.

In order to avoid the possibility of mistakes through nonexperienced judgment, the writer examined the comparative test records in Cincinnati, with the aid of the Master Painter of one of the most prominent railroads, and of a house painter of 35 years' experience. The records cover four years, beginning with tests made on the Lake Shore & Michigan Southern, under the administration of Mr. A. M. Waitt, then General Master Car Builder. In all about 2,500 test panels have been painted and placed in a southern exposure in the smoky atmosphere of Cincinnati, Ohio. The tests were progressive, and have had an exposure of two to four years under what seem to be fair conditions. In order to examine it in another atmosphere, other similar comparisons were made at Oaks Corners, near Geneva, New York. The tests were made on 4 by 15-in. panels of pine and poplar boards, sheet steel, galvanized iron and black iron. In some of the tests steel sheets were allowed to rust for three months before the paints were applied. In the comparison the paints used were the new carbon, both crude and "burnt," iron oxides, Venetian red, ochre, red lead, white lead, lampblack and graphites. These were used alone and in combination with the new paint. For the color-fading tests, ochre and chrome yellow were used. Pure boiled linseed oil was used in most of the tests, but in some of the series other oils were tried, for example, 150 tests were made with raw oil. Four kinds of japans were also used. For each paint a clean new brush was employed, and each sample was applied to a complete set of the panels, the temperature, mixture, formula and conditions of the application being carefully recorded. Care was also taken to use panels from the same board for the different paints applied in each separate test. The lower portion of each panel had three coats and the upper portion two coats in each case. None of the paints was found sufficient when applied in a single coat.

In general the comparison showed that the new carbon pigment, both burnt and crude (the crude contains a little natural oil somewhat like that of lampblack) stood as well as any of the samples, and it is evidently a first-class article. It appears as well as the best iron oxides and lampblack when taken alone, and when combined with either of these it seems to be in better condition (after two years) than either taken alone, even the lampblack. The same applies to the tests of lead paints. Introducing the new pigment into a mixture with the other pigments improved them and helped to hold the colors, the fading of some of them being surprisingly slight.

One of the experts present was a strong advocate of iron oxides and the other of lampblack. They and the writer agreed in the conclusions presented here.

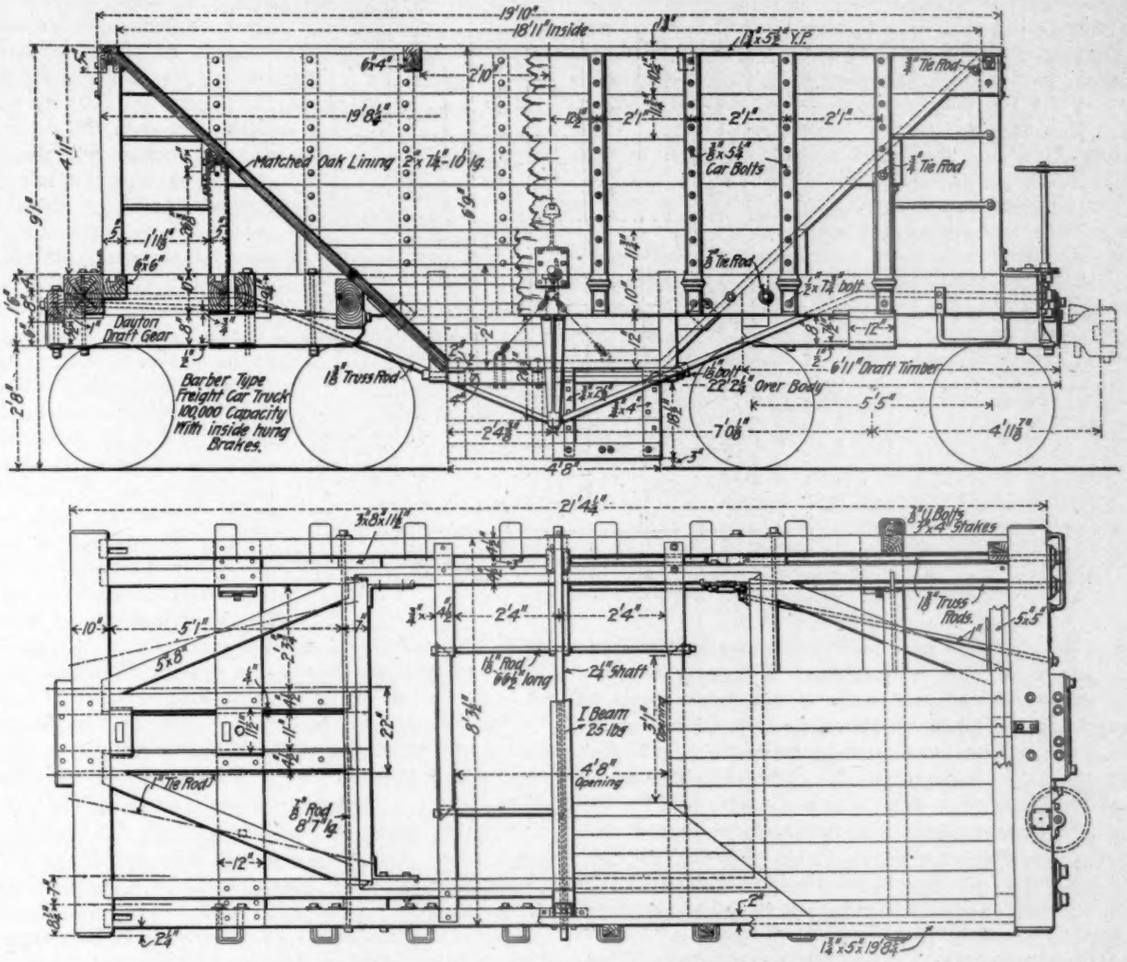
The new paint mixes, grinds and dries much better than lampblack, it does not settle in two years, it showed no corrosive action, and preserved the metallic surfaces bright and clean. No paint can eradicate rust, but this appears to arrest it. It is elastic and tough, almost like rubber, its covering qualities are good, and it did not crack in the sun. Tests covering 11 months in sea water, and practical application on roofs of buildings indicate that it has stood the action of tannic acid and steam in a severe test.

The management of the Mamolith Carbon Paint Company is in the hands of Mr. A. B. Burtis, as General Manager. He is well informed as to paints, and is widely known from his former connections with the Sherwin, Williams Company and Lowe Brothers. To those who know him the fact that he has taken it up is a strong endorsement. The address of the company is 503 Johnston Building, Cincinnati, Ohio.

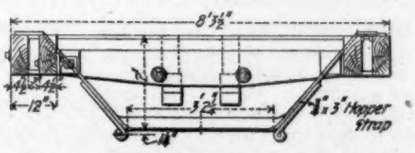
IMPROVED ORE CAR, 100,000 POUNDS CAPACITY.

Chicago, Milwaukee & St. Paul Railway.

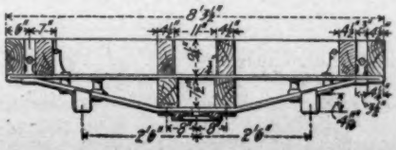
On roads having a large amount of ore traffic an interesting class of special equipment has been developed for this service which requires great strength, large carrying capacity, rapid loading and discharging facilities, simple construction and short cars to suit the ore pockets at the docks. In the Lake Superior region there are in use several designs of hopper ore cars, and by courtesy of the motive power officers of the Chicago, Milwaukee & St. Paul Railway the latest improvement on that road is illustrated. This car carries 50 tons of ore and weighs 29,300 lbs., a ratio of 77 per cent of paying load. This car, built of wood, weighs but 500 lbs. more than the pressed steel ore cars of the same capacity built several years ago by the Schoen people for the Lake Superior & Ishpeming, the light weight of which was 28,800 lbs. These two designs give the highest ratio of paying load that we have seen, and the comparison is exceedingly favorable to the wooden car. The design is similar to one brought out on this road last year except that the present construction omits the backbone or cen-



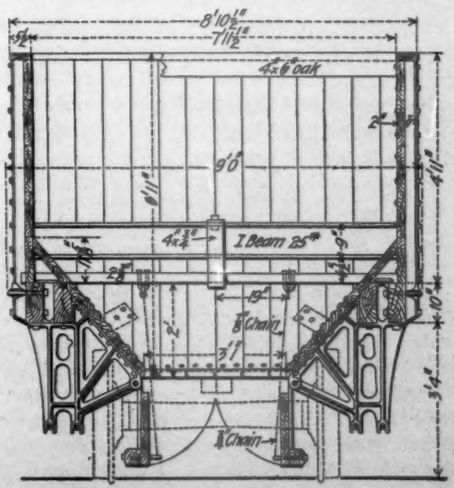
New Ore Cars, Chicago, Milwaukee & St. Paul Railway.



Transverse Section Near Center of Car.



Transverse Section Near Body Bolster.



Section Through Hopper.

ter sill and leaves the center opening of the hopper entirely free for unloading. We are informed that there is no noticeable deflection of the sills when the car is loaded with 56 tons of ore.

Partial elevations and sections with a floor frame plan are presented in the engravings. There is but one hopper with the doors swinging sidewise and held by chains from a central shaft. The underframe is very "stocky" and strongly braced. There are but four through longitudinal sills and four 1⅜ in. truss rods. These rods support malleable iron king post castings which have wings bearing against the sloping sides of the hoppers and in this way a portion of the hopper load is taken directly to the truss rods. Two ¾ by 3 in. hopper straps, a number of transverse rods and two 4 by 6-in. cross beams tie the car across at the top of the box. A 25-lb. I-beam at the center and a pair of 7 by 12-in. cross beams at the sills furnish lateral support at the bottom and the corner bracing and tie rods are shown in the plan view. The end supports of the box are upon 6 by 6-in. cross timbers placed inside of the end sills. Draft timbers 7 ft. long are attracted to 4½ by 10-in strut sills, which are re-enforced by tie rods, and the Dayton draft rigging is attached between the draft timbers. The elevation shows the bearings at the ends of the draft timbers upon the large cross timbers. The bolsters are of the ordinary plate form 12 ins. wide. The cars are equipped with Barber 50-ton trucks, inside hung brakes and Monarch brake beams. It is evident that the entire structure is intended to withstand the roughest kind of service. The chief dimensions are summarized in the following table:

100,000-Pound Ore Car, C., M. & St. P. Ry.

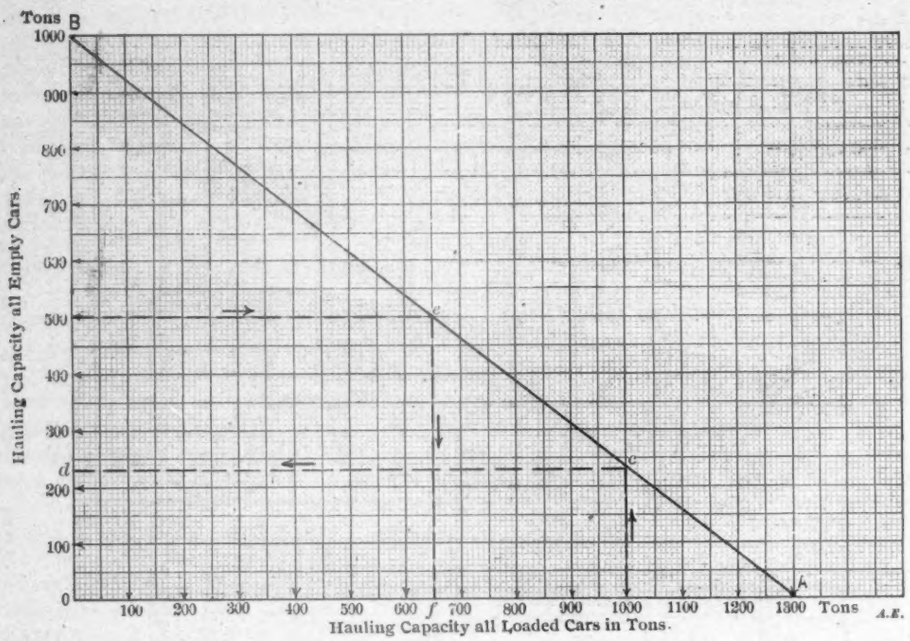
Length over body	22 ft. 2¼ ins.
Length over box	19 ft. 10 ins.
Width, outside	9 ft. 10½ ins.
Width, inside box	7 ft. 11½ ins.
Height over all	9 ft. 1 in.
Height to under faces of sills	3 ft. 4 ins.
Trucks, wheel base	5 ft. 5 ins.
Weight, empty	29,300 lbs.
Cubic capacity, level full	567.59 cu. ft.

J. A. Fay & Egan Co., Cincinnati, Ohio, manufacturers of wood-working machinery, have taken out in the year 1900 about 100 patents. Their claims on some of these patents are being infringed by several manufacturers of wood-working machinery through ignorance or greed, and are copying their machines. Neither the J. A. Fay & Egan Co. nor the Egan Co. have had a patent suit since their consolidation in 1893, but have now retained a firm of lawyers, and it is their intention as a joint company to protect their rights in the courts.

TONNAGE-RATING—LOADED AND EMPTY CARS.

To those who have not closely watched the development of tonnage rating, some of the papers and committee reports on this subject must seem exceedingly complicated. Mr. L. R. Pomeroy, of the Schenectady Locomotive Works, recently stated the fundamentals of the subject in a simple way.

If the rating of a given engine is desired and a trial train of loaded and empty cars is provided, the "commercial" capacity of this engine in both loaded and empty cars may be easily ascertained on the road. For example, let the rating be 1,300 tons of loaded cars and 1,000 tons of empties. Use cross section paper to construct a diagram as follows: Establish the point A at 1,300 tons of loads and the point B at 1,000 tons of empties. Draw a straight line between them and the diagram will show, without calculation, how to fill up the train. Suppose we have 1,000 tons of loaded cars to haul and we desire to know what tonnage in empties the engine can haul in addition, in order to complete the rated load.



From the point opposite 1,000 tons at the bottom of the diagram follow the vertical line to the diagonal at c. Then follow the horizontal line from c to d at the left-hand side of the diagram, where we find 230 tons as the amount of empties to be taken. Or if we had 500 tons of empties and desired to know how many tons of loads to take for a full train, start at 500 tons at the left and follow horizontally to the diagonal at e. Then proceed downward vertically to the base line at f, where we read 650 tons as the amount desired in loaded cars to complete the rating. Such a diagram may be constructed for each division and each class of engine. This scheme is presented as a suggestion to those who for any reason do not care to go deeply into the higher mathematics of the subject.

"Drafting Room and Shop Methods" was the subject of a paper by F. H. Ball, Mechanical Engineer, American Engine Company, New York, presented at a recent meeting of the Junior Members of the A. S. M. E., which brought out a discussion of the importance of the position of the drafting room. First considered as a place where drawings are to be made as directed by someone from outside of the office, and second as a center for the departments with which it is directly in touch. Some rules for tracings, that are worth consideration, were given as follows: Views of more than one piece should never be put on a sheet. All the views of the same piece need not be put on one sheet. Use sheets as small as practicable and still have the drawings readable. Mr. Ball believes that the draftsman and not the pattern-maker should be the one to decide how much should be allowed for finish on a casting, and gave the system employed by the American Engine Company, in which f = 1/16 in., *f* = ⅛ in., F 3/16 in., ff = ¼ in., and FF = ⅜ in. These are placed on the drawings by the draftsmen. His idea is to make the drafting room responsible for the design of a machine, thus requiring a draftsman to follow up his own work, until it is completed in the shops. This is in accordance with our idea of what a draftsman should be, a man of all-around usefulness, competent for advancement.

The Rogers Locomotive Works, at Paterson, N. J., have been purchased by F. P. Holran, Transfer Agent of the Louisville & Nashville, and Elliott C. Smith, connected with the banking firm of Norton & Co., at 33 Wall street. These works are to be considerably improved and some extensions made to the buildings.

A QUESTION OF SQUARENESS.

Locomotive Frames and Freight Trucks—Principally Trucks.

Some things are born square, some have to be made so and kept so, and to a man accustomed to expect a locomotive to be designed with that end in view, there would appear to be some inherent tendency in the case of the average freight truck which acts in place of a premeditated design, for in many cases its construction constrains it to so slight an extent that it must pretty nearly arrange its lines to suit its own sweet will.

In a locomotive the frames are relatively stiff, thoroughly well braced at the cylinders, and, in the squarest of locomotives, the 8-wheel American type, braced again at the footplate. The footplate exercises a great influence on the maintenance of squareness; and an engine that is simply braced by the cylinders can and will get out of line far more easily from the absence of what our bridge friends would call diagonals. Fig. 1 shows the manner in which the frames must deform to allow a footplate engine to get out of line, and this the only way, provided the length of the frames does not change through bolt connections loosening. To deflect sideways, the frames must make a double bend and consequently have four times the resisting power of those in an engine built as sketched in

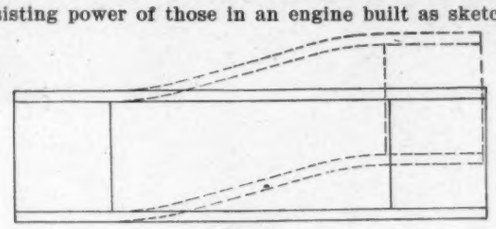


Fig. 1.

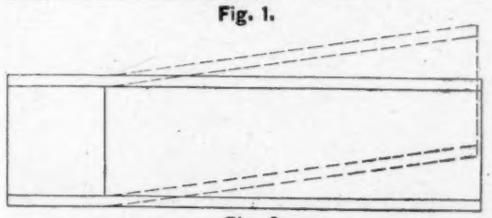


Fig. 2.

Fig. 2, where the connections at the back end are not sufficiently rigid to diagonally brace the frames. Such an engine is held in line chiefly by the boiler, and where the firebox connections are laterally weak, as in the case of wide firebox boilers supported by rocking links, the frames will frequently move sideways to a considerable extent. When the firebox is supported by expansion plates, evidence is occasionally found of heavy lateral strain being carried by the boiler, in the loosening of smokebox bolts and the rivets at the side of the front end which connect it to the barrel of the boiler. For this reason the writer has advocated a strong braced casting within the ashpans of such engines which would connect the frames and keep them from, as one well-known superintendent of motive power put it, "wiggling their hind ends."

Still, at its worst, the locomotive has its reasons for keeping square, but in the case of some freight trucks, and even passenger trucks, these reasons are more conspicuous by their absence than their presence. Take the case of the wooden frame side-swing truck. Two timbers, 4 by 12 ins., or thereabouts, are bolted to the end castings by four ⅝-in. bolts, and also take the arch bar bolts, forming a yielding backing to prevent those bolts from being tightened up properly. Fig. 3 shows the lines of the construction and also the form it takes when out of line.

Now there is evidently very little strength in such a construction to keep it from being forced out of square, and yet, in spite of this fact, such trucks are in very general and successful use. The rigid diamond truck is not much better until an iron spring plank is substituted for the wooden one, and when iron trucks are considered it is possible to arrive at an approximation of the force which is required to deflect them out of square. In the case of the side-swing truck with iron channels riveted to the truck end castings, the resisting strength of these channels to flexure, as shown in Fig. 4, is 950 lbs. at the arch bar, adopting a 12-in. 30-lb. channel, which is common practice. In the case of the rigid truck in which the spring plank is a 12-in., 24-lb. channel, this force becomes 22,200 lbs., but the rivets connecting the spring plank to the columns then become the weak point. Allowing eight ¾-in. rivets at each end, or four to each column, their full shearing strength is only equal to resisting a force of 3,800 lbs. at the arch bar. Now what is the force that could throw such a truck out of square? Evidently the greatest factor would be that caused by the wheels on one side having a greater running diameter than those on the other, a difference that might amount to ⅛ in. on the circumference. One wheel would then be obliged to slip, if the truck were held square, and with a load of 10,000 lbs. per wheel, 1/5 of this, or 2,000 lbs., would be at the least, the force required to slip the wheel. It might be objected that the force must be proportional to the difference in the diameters of the wheels and that it is continuous and not as large as that required to actually cause slip, but an inquiry into the force required on the assumption of continual slip will demonstrate the fallacy of such a contention. The circumference of a 33-in. wheel is about 104 ins. Taking this as that of the smaller and 104⅛ ins. that of the larger, it would be necessary in every 104 ins. of travel to move one wheel backward ⅛ in., against a resistance of 2,000 lbs. or the work

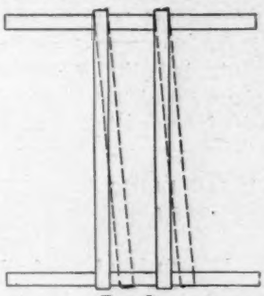


Fig. 3.

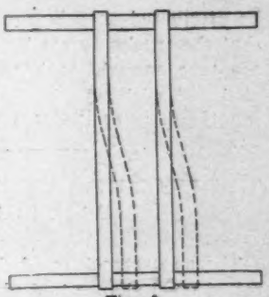


Fig. 4.

done would be $\frac{2000}{8} = 250$ inch-pounds. This would have to be done in 104 ins., a mean resistance of $\frac{250}{104} = 2.4$ lbs. Such a force would evidently not cause a wheel to slip if applied continuously, and the variation in work with difference in diameters is accounted for by the fact that one wheel advances ahead of the other until, if the truck were strong enough, a strain is brought on it at which it slips. It then resumes its natural position and with wheels with a great difference in diameters this slip takes place more often than with those in which the difference is small, but the force required is the same in both cases, and depends simply on the weight on the wheel.

In the extreme case when both wheels on one side are in excess a strain of from 3,000 to 4,000 lbs. would thus have to be exerted to return the truck square, and but one of the constructions above considered, the rigid truck with metal spring plank, is at all strong enough, and even in that case, it can be safely said it is not strong enough for practical working. Since all such trucks are running, and running satisfactorily, evidently some other cause must be looked for to account for such a result and the most reasonable explanation is afforded by the conical form of the wheel tread.

Assume a truck with equal wheels to be a little out of square, the wheels will tend to run to one side, and in doing so will quickly cause the backward wheel to run with its flange close to the rail. This will make its running diameter greater than that of the wheel on the opposite side, and it will consequently gain on the other wheel and pass it, whereupon the reverse action would take place until the wheels settled down to run true. There would be limitations to this action, as in case the

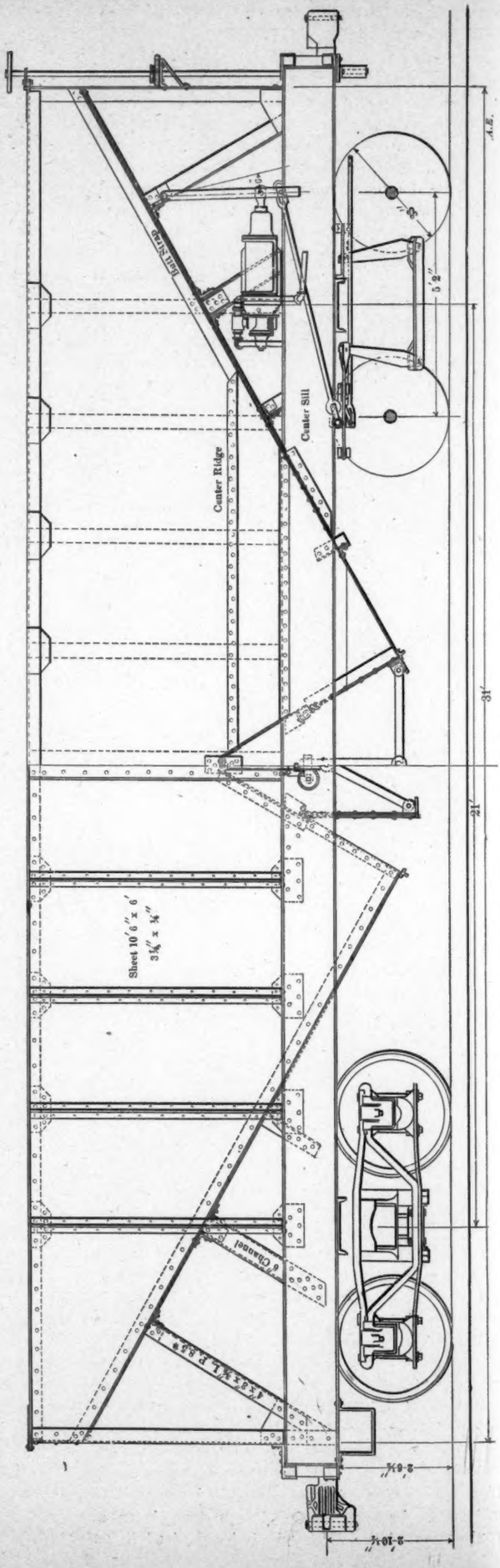
truck was badly out, the back wheel flange might bear against the rail and prevent the wheels resuming their proper position for a considerable distance, as for instance when a car passes a crossover the wheel flange can often be heard grinding against the rail for some little time, until a lurch of the car or some similar action gives the back wheels a chance to move ahead and catch up with their companions. A difference in diameters too great to allow the conical tread to equalize matters would lead to permanent trouble, but since the difference in diameter available by the two wheels running on different parts of the tread is ⅛ in. in each wheel, evidently wheels that are matched in accordance with the tape sizes will have sufficient margin for square running.

That such an action takes place was called to the writer's attention by the trucks originally used on some ballast cars. In these trucks the springs were carried on a casting on the bottom arch bar, no spring plank being used, and although diagonal tie rods were subsequently added connecting the lower ends of the column bolts, the original trucks depended entirely on the bolsters to maintain them in line, the bolster being provided with guides as usual in rigid trucks and offering but very slight resistance to any force tending to throw the truck out of square. Yet these trucks ran very satisfactorily and no trouble was experienced with them on this account. It would appear to the writer that if allowed to do so, a truck will, with fair wheel conditions, run square, and that the reason such varied arrangements have been used successfully may be attributed to this quality. What is wanted is to be sure that the trucks do not hold the wheels out of square, that they are true enough to keep in alignment, and that they are equipped with wheels that are mated in accordance with the requirements of the Master Car Builders' Association.

THE WOODCOCK STEEL HOPPER CAR USING STRUCTURAL SHAPES AND PLATES.

The superstructure of this car is made entirely of standard rolled steel shapes and plates, the design being by Mr. W. H. Woodcock, Chief Engineer of Dutilh-Smith, McMillan & Company, of Philadelphia. Two channel side sills and two I-beam center sills with strong end sills of plate and angles constitute the underframe, the draft gear being placed between the center sills. With an approximate cubical capacity of 1,810 cu. ft. the car is designed to carry a load of 105,000 lbs., the light weight being 36,980 lbs. The side plates, ridge and bottom plate are ¼ in. thick, weighing 10 lbs. per ft. As a backbone there are two 15-in. I-beam center sills tied in the center with plates and four angles placed back to back and riveted to the webs of the beams. The ridge plates are also riveted to the flanges of the beams. The side sills are 15-in. channels stiffened by the two center side plates carried down and riveted to the webs of the channels. The end sills consist of ½-in. plates the full width of the frame, cut out at the center for the coupler shank. They are tied to the side and center sills by angle connections and gusset plates and are re-enforced by angles riveted over and under, as shown in the drawing. Special attention was given the end sills with a view of making them stiff and strong. Several forms of hopper mechanism have been designed for this car. One employs chains for closing the doors and another uses toggles outside the doors. With the latter arrangement the doors cannot open or work loose when closed and they are easily opened or closed by the mechanism.

The top of the car is stiffened by 4 by 3-in. angles and by 4 by 2-in. verticals of T-section. The floor angles are 4 by 4 ins., the end supports are of the same size, the platform and body angles and the platform bottom angles are 4 by 3 ins. At the ends the body braces are 6-in. channels and 4 by 3-in. angles. The trucks are of the diamond type with Mr. Woodcock's special cast steel bolsters and malleable iron journal boxes for 5½ by 10-in. journals. The designer has had a wide expe-



The Woodcock Steel Hopper Car Built of Structural Shapes and Plates.

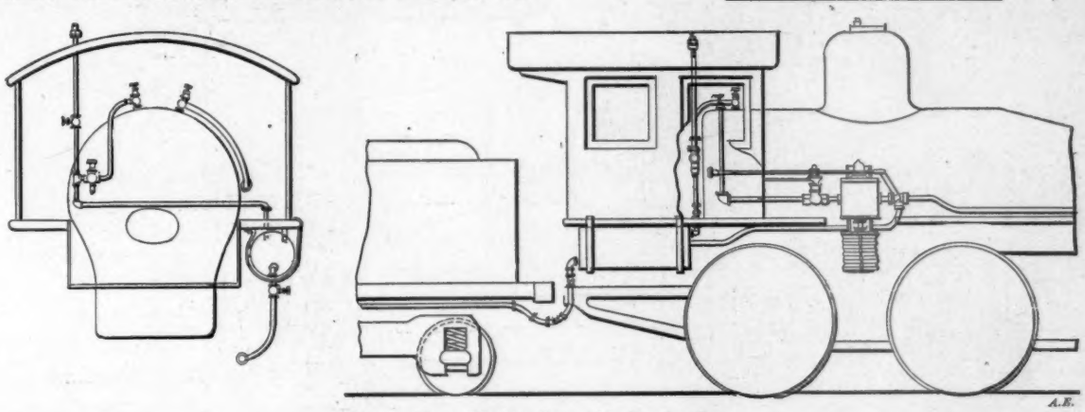
rience in the manufacture and testing of metals both here and abroad and has developed a patented alloy which is specified for the truck and body bolsters. Open-hearth steel will be used which contains an alloy for the improvement of the physical qualities of the casting. By the use of this alloy the ultimate tensile strength is increased 30 per cent. and the castings are solid and free from mechanical defects. For the material of this car soft steel is specified with ultimate strength between 54,000 and 62,000 lbs., elastic limit, 50 per cent. of the ultimate strength, and an elongation of 25 per cent. in 8 ins. If basic open-hearth steel is used for the plates the phosphorus must not exceed 0.035 per cent., and if acid, it must not exceed 0.08 per cent. Other features of the design as to details are shown in the drawing.

HEATING PASSENGER TRAINS WITH EXHAUST STEAM FROM THE AIR-BRAKE PUMP.

A new system for utilizing the exhaust steam from the air pump of a locomotive for the purpose of heating passenger trains is being applied quite extensively to locomotives on the Maine Central Railroad, and is also used on other New England roads. The system is simple; consisting of a three-way cock attached to the exhaust pipe immediately in front of the pump and operated by a lever to which is attached a reach rod that passes into the cab to the engineer. Of the two pipes issuing from the three-way cock, one is connected by the ordinary exhaust pipe to a carefully jacketed reservoir about 40 ins. long and 20 ins. diameter, hung beneath the cab. The second exhaust pipe is connected with the smokestack. The outlet pipe to this reservoir is at the rear end near the bottom and is connected to the train steam pipe by means of a flexible hose connection.

The drawing shows the arrangement of the piping and the several parts of this apparatus, the operation of which is very simple. When the reach rod is pulled back, the exhaust steam from the pump enters the reservoir and when pushed forward it is passed to the stack. The pressure maintained in the reservoir is of course determined by the number of cars to be heated. The general rule is 20 lbs. for a train of 4 cars or less, and 4 lbs. additional for each extra car. On some of the 10-wheel engines of the Maine Central for heavy passenger service as high as 65 lbs. pressure is carried in the reservoir. This naturally raises the question as to whether the action of the pump is not blocked and some trouble experienced in maintaining the proper air pressure for the brakes. Formerly the only resistance that the pump had to overcome was the main reservoir pressure of about 90 lbs. plus the friction. This added to a pressure of, say, 30 lbs. for heating a train of six cars, would increase the resistance to be overcome. With the common use of a boiler pressure of 200 lbs., this is reported to be a very easy matter. Mr. Frank Coggin, in bringing this method of heating before the January meeting of the New England Railroad Club, said that the largest 10-wheel engines used on the Maine Central carry a back pressure of 65 lbs. when needed. He stated that the road had never experienced the slightest difficulty in maintaining the brake pressure, nor is there much, if any, difference in the matter of time required in heating by this system and the usual method of heating direct from the boiler. In order to maintain a constant pressure in the reservoir, an automatic relief valve is placed on top of the cab and set at the desired maximum pressure.

There is also another controlling condition as to the length of train that can be heated. The number of stops will control the amount of steam the pump will furnish to the reservoir and in this respect no trouble is experienced for local trains. For heating through trains and for consideration of zero weather there is also a connection from the reducing valve of the boiler directly into the reservoir. If the pump does not furnish sufficient steam for heating, the pressure in the reservoir falls below that at which the reducing valve was set and allows steam to enter direct from the boiler to make up the deficiency. On the other hand, should the pump furnish more steam than is required to heat the train, the excess is passed off by means of the relief valve on top of the cab. In this way all the heat from the pump is utilized for heating, the supply from the boiler being used only to make up the deficiency. It is seldom necessary for local or even express trains, in moderate weather, to use the direct boiler supply. The various patents granted upon this device are owned by the Economy Car Heating Company, Portland, Me., who also have the handling of this system of heating.



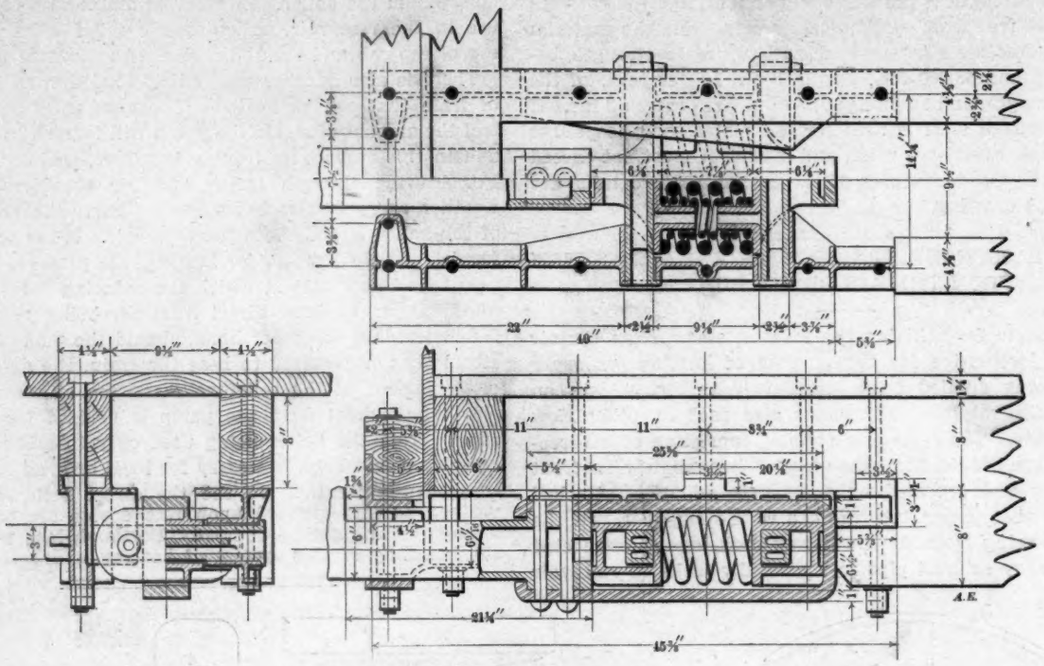
Steam Heat Piping from Air-Brake Pump.

THE "TIP TOP" DUPLICATOR.

The Felix F. Daus Duplicator Company, No. 5 Hanover street, New York, manufacture a duplicator which is a great time and labor saver. It requires no stencil, roller or printer's ink. It is reliable, very clean and altogether the cheapest and best duplicating apparatus for drawing-rooms and office use that we have seen. It will give from 100 to 150 distinct copies from any writing or drawing and 50 to 75 copies from typewritten copy when special typewriter ribbons are used. The duplicator consists of two rollers, one pivoted at each end of a shallow oblong case, with the printing surface between them, over which the negative paper is passed. The rolls contain five yards of negative paper and can be rolled back and forth six or eight times, when it should be replaced by another roll. Four different sizes of this apparatus are manufactured; the smallest with a printing surface 8¾ by 13 ins., and the largest size 20¾ by 23½ ins. The following recommendations from those who have used this device speak for themselves. Mr. J. A. McCrea, Engineer Maintenance of Way, Pennsylvania Lines West of Pittsburg, says, in part: "I am very well satisfied with the working of the duplicator and have recommended its use to others." Mr. C. W. Bassett, General Passenger Agent, Pittsburg & Western Railway Company, writes: "I have made use of the new roll of paper this afternoon and find the work highly satisfactory."

DAYTON DRAFT GEAR AS APPLIED ON THE ATCHISON, TOPEKA & SANTA FE RAILWAY.

In this issue is printed an account of service tests of draft rigging on the Atchison, Topeka & Santa Fe, and by courtesy of the Dayton Malleable Iron Company the construction of the draft rigging of their type, which was one of those tested, is shown by the accompanying engravings. This construction is similar in principle to the earlier designs previously illustrated in these pages and the engravings therefore do not require explanation. Fig. 1 shows the device with malleable draft sills as applied to the coal cars referred to in Mr. Sanderson's report. The arrangement as applied to cars with steel center sills is shown in Fig. 2. These cars have wooden end sills. Both designs employ twin springs and in both cases the carry iron is a strap bolted across under the extensions of the malleable draft arms. In Fig. 2 it will be seen that the transverse keys are held in place by bolts passing through them. The center sills are therefore not cut for the passage of the keys, but are merely drilled for the bolts. The draft gear is manufactured by the Dayton Malleable Iron Company, Dayton, Ohio. The number of separate pieces in these designs is conspicuously small.



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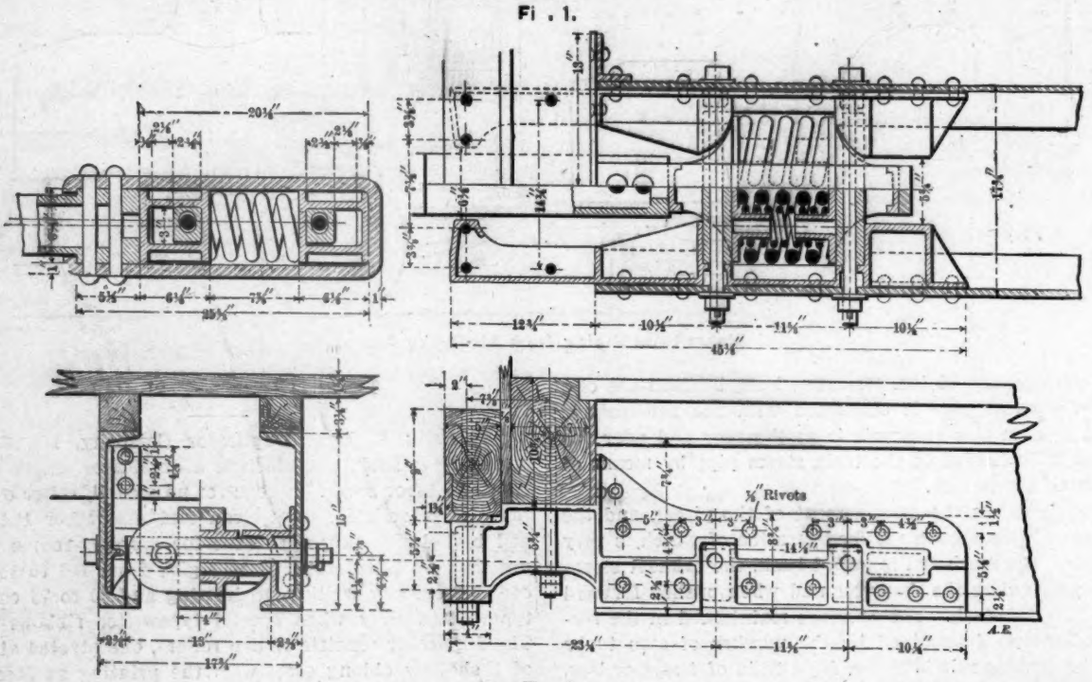
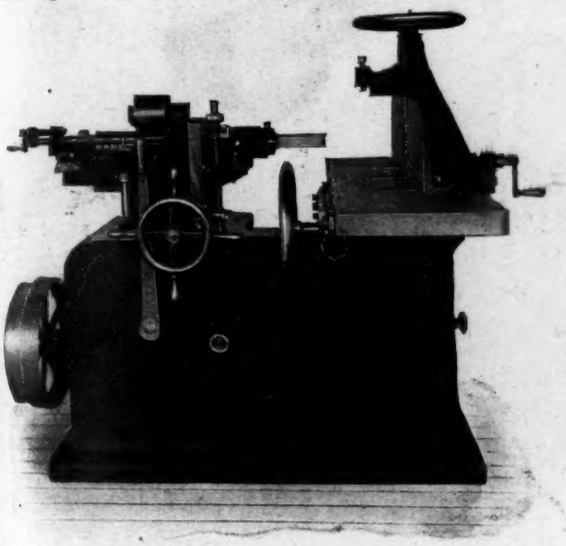


Fig. 2.

The Shelby Steel Tube Company have found it necessary to provide for the greatly increased volume of their business by an extensive enlargement of their selling facilities. A large stock of tubes will be carried at the New York store house for quick deliveries in the Eastern and Southern territory, and the Western States will be supplied from the several mills. The main selling offices are now in New York and Chicago. All correspondence west of New York, Pennsylvania, West Virginia and the coast line States should be addressed to the Chicago office, and that from New England and the Atlantic coast States should be addressed to the New York office, 258 Broadway.

NEW HORIZONTAL HOLLOW CHISEL MORTISER.

Among the very latest designs in mortising machinery is that of a horizontal hollow chisel mortiser manufactured by the S. A. Woods Machine Co., and illustrated in the accompanying engraving. In addition to the advantages possessed by other mortisers of this kind, it is equipped with many special features of convenience, which, together with its superior construction, makes it particularly well adapted to the requirements of car and railroad repair shops, wagon factories and ship-building plants. Unlike other machines of medium size, the ram or chisel carriage has a vertical adjustment instead of giving this to the table, thus ensuring more rigid support for the latter. Another of the noticeable features of the superior design is the frame of the machine, which has a base of such dimensions as to give thoroughly efficient support for the table. The carriage has a travel of 9½ ins. and will raise a distance of 11 ins. above the table. Timbers up to 12 ins. square may be clamped, and chisels up to 1½ ins. can be successfully used on hard wood.



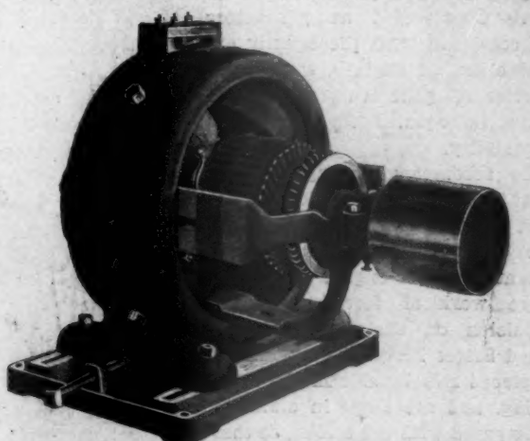
Hollow Chisel Mortiser.
S. A. Woods Machine Co., Boston, Mass.

The table has a horizontal travel of 18 ins. and is provided with patent stops for laying off double mortises. This machine is only one of a number of improved types of horizontal and vertical mortisers, besides a general line of high grade wood-working machinery manufactured by this well-known company. The builders will furnish any information that may be desired on the many special points of this horizontal hollow chisel mortiser, or any other particular kind of wood-working machine. The engraving illustrates the construction so clearly as to render more complete description unnecessary. The address of the S. A. Woods Machine Co. is South Boston, Mass.

IMPROVED DIRECT-CURRENT MOTORS.

Manufactured by the New England Motor Co., Lowell, Mass.

The distinguishing features of the direct-current motors have in the past few years been greatly improved, and in large shops where electric motors are now so generally used for power distribution their results are being appreciated. The motor shown in the accompanying engraving is one of a complete line of motors built by the New England Motor Co. for relatively slow speed and high efficiency. They do not spark, and they embody the successful features of modern multipolar design in connection with a number of special features. They are made either partially or completely enclosed, the closed form being used for dusty and damp places. A very striking feature of this machine is the method of supporting the armature. As will be seen in the engravings, the bearings, instead of being mounted on independent end plates or brackets, are cast together in the form of a double yoke. The yoke is supported within the field magnet frame and can easily be removed or its position in the field ring changed so that the motor can be mounted in a vertical position, fastened to a wall, or at any desired angle. Slots are also provided in the casting of the field ring by which the yoke may be adjusted longitudinally or the yoke and armature removed bodily from either side, without losing the brush adjustment. The brush-holders are inside the fields and are carried by substantial lugs cast to a light, but stiff ring, which fits in the same diameter as the field cores and the yoke. This method of mounting the armature allows a ready means of centering it magnetically in the field, should the motor not be properly leveled. Without stopping the motor, two bolts can be loosened and the yoke shifted slightly in one direction or the other until the armature is brought to its proper position in the field and given the proper end play. The armature is of a standard and improved design, built of carefully laminated annealed sheet steel of highest permeability. The commutator is made large and substantial and built with a ventilated head. The coils at the back end are securely mounted and protected by a well-finished solid protecting flange to avoid the collection of dust, dirt or oil within the coils. This company also manufacture a line of semi-enclosed and dust-proof bipolar motors, together with a complete line of slow-speed motors and generators of efficient design suitable for direct-connected service. All parts of these machines are interchangeable and durable, and the absence of outside cables gives a highly finished appearance.



Type M. E. Motor—New England Motor Co.

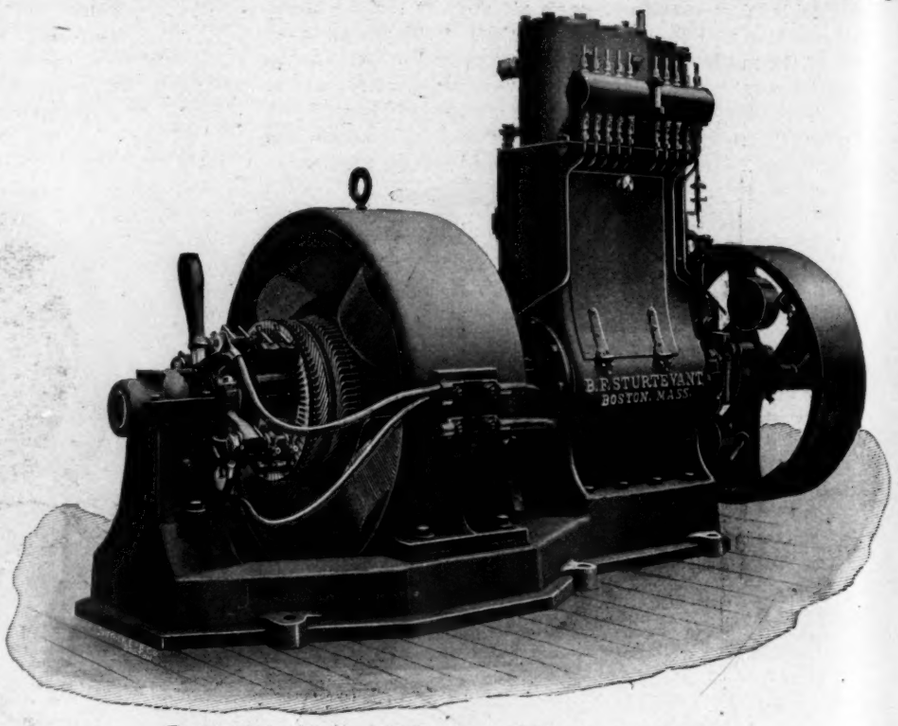
Yoke and Armature, Showing Core with One Coil.

The hammer shop of the Schenectady Locomotive Works, a frame building 60 by about 250 ft., was destroyed by fire Saturday, the 23d. The building and contents were insured in the Manufacturers' Mutual Insurance Companies of New England, who adjusted the loss on Monday, the 25th, and a contract was immediately let for a new building 85 by 365 ft., to be constructed of steel and brick. Meanwhile the old building will be patched up, so that several of the hammers can be started into service this week, temporarily, and with contracts let with outside forges for shapes, it is expected that the work of the Schenectady Locomotive Works will not be seriously interfered with by the loss by fire.

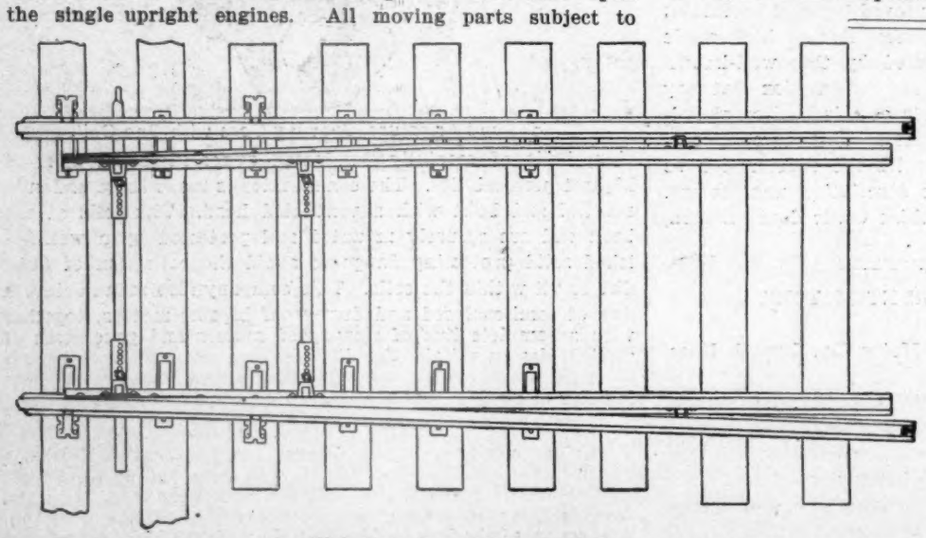
A NEW STURTEVANT GENERATING SET.

Modern steam engineering practice demands an engine capable of sustained operation at high speed, possessing the utmost refinement in the matter of speed regulation and developing the maximum horse-power with the minimum of weight and floor space. For many years the B. F. Sturtevant Company, of Boston, Mass., have devoted themselves to the most careful design and development of an extensive line of simple, compact and strictly high-grade engines to fulfil these requirements. Their experience in fan practice has been of untold value, for the conditions have been such as to concentrate attention upon the essential features of high speed and continuous operation. The somewhat more recent development of the fan motor by the same company has placed at its disposal a very complete line of machines ranging in capacity from ¼ to 125 h.-p. Constructed as generators and combined with the equally extensive line of engines, these form a series of generating sets which cannot be equaled for variety or adaptability.

The accompanying engraving is of a 5 x 4-in. enclosed double upright engine and a standard 12 kw. type originally designed for the generator. The engine is of the severe work of forced draft fan propulsion on the vessels of the United States Navy. The cylinders are placed side by side in the same casting, and are large in diameter as compared with the stroke, so that great power may be developed at high rotative but moderate piston speed, making the engine particularly suitable for direct connected dynamo driving. The cranks are set opposite at an angle of 180 degrees. The steam admission to both cylinders is regulated by a single piston valve, under the control of a shaft governor of the same design as that used upon the single upright engines. All moving parts subject to friction are of steel and the bearings of ample size. Automatic relief valves are provided to prevent any danger of damage by water in the cylinder. The magnet frame of the generator is of cast steel, and the shaping of the pole pieces and proportioning of magnetic field and armature are such as to insure absolutely sparkless operation under all changes of load. The temperature rise after a full-load run of ten hours will not exceed 40 degrees Cent. The bearings, which are ring oiling, are built upon the ball-and-socket principle. The armature is of the barrel-wound type, the interior surface of which is perfectly smooth, offering no opportunity for the collection of oil or dust. Ventilation is effected by the use of specially-constructed vanes, forming air ducts between the laminae of the core. These convert the armature into a blower, and create a strong draft through the windings. Carbon brushes are used exclusively and are mounted in holders of the sliding socket type, having every facility for ready adjustment. All machines are thoroughly tested before shipment by being given a full-load run during a continuous period of six to eight hours.



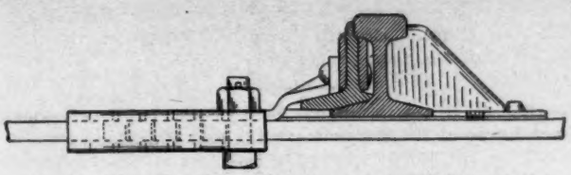
Enclosed Double Upright Engine and Standard Generator.



Weir Re-enforced Split Switches.

RE-ENFORCED SPLIT SWITCHES.

Since the introduction of split switches to the railroads of this country the Weir Frog Company, of Cincinnati, O., have devised a number of different designs of these popular switches. The one illustrated by the accompanying engravings is the most recent and altogether the best design. It will be seen that the switch rails are re-enforced on both sides so that if breakage should occur the re-enforcing will hold the parts together with safety to operation, until a new rail can be put in. This form of double re-enforcing is claimed to be superior to the methods of other manufacturers who re-enforce the switch rail on one side only. In this latter method should the switch rail break the broken parts are apt to project from the line of the rail and present an obstruction, which may cause derailment, but

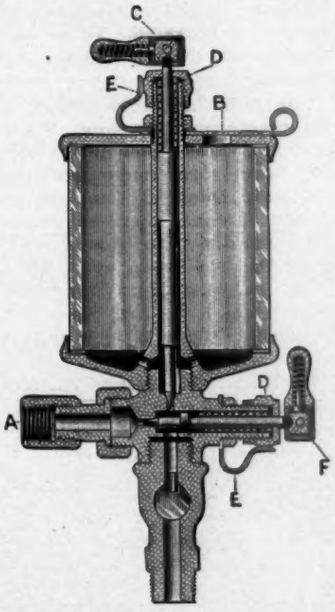


Section Showing Adjustable Head-rod and Fastening.

with the Weir method this double re-enforcing will hold the broken parts in alignment and with perfect safety to operation. The adjustment of these switches is made at the switch lugs, the latter being drilled with 1¼-in. centers and the switch rods with 1⅛-in. centers. Owing to this difference in drilling an adjustment of ⅛ in. is obtained at each movement of the switch rod. When adjustment is necessary, the bolts are withdrawn and the rods lengthened or shortened as occasion requires, thus providing for any change of gauge or wear of parts. This form of adjustment is easy and rapid. Either switch rail may be adjusted independent of the other, or both may be adjusted at the same time. Midway between the heel of the switch and where the heads of the rails diverge, a stop lug is bolted to the switch rail; this keeps the switch rail in perfect line when thrown against the stock rail. The Weir Frog Company also makes this design with one adjustable rod.

IMPROVED FORM OF PRESSURE OIL CUP.

The improved form of oil cup which is shown in the engraving, in vertical section, has the advantage in not having the oil in the glass cylinder under pressure. This does away with the leaky joints and a possibility of the glass cylinder or reservoir being broken and thus rendering the cup useless, besides losing the oil. In this new oil cup the glass reservoir is used as an auxiliary supply in case the supply under pressure should be cut off. The pressure supply of oil is piped through the union, A, which opens into the oil duct leading to the bearing. This supply of oil is, in the matter of regulation, very simple, and easily affected by the valve, F, and is not disturbed by jarring of the machinery. The feed, when once adjusted, can be turned on or off by simply raising or lowering the lever, F. The auxiliary oiler is controlled by the cam lever, C, in the same way as the lever F. A sight-feed is placed in the base which enables the dropping oil to be clearly seen at some distance. The cup is heavy, substantial, practical, and simple in operation. All parts of the cup are made of cast brass. This oil cup is manufactured by the Lunkenheimer Company, Cincinnati, O.



BOOKS AND PAMPHLETS.

"Monarch" Pneumatic Tools.—Some of the more recently improved Monarch pneumatic tools are illustrated in this pamphlet, which is the Standard Railway Equipment Company's latest catalogue of portable air tools. The three hammers illustrated are their size "AA" for light chipping and calking, size "A" for general run of chipping and calking, and size "B" for heavy chipping and light calking. Their Monarch long-stroke riveter, which is especially adapted to bridge erection, tank work and steam-tight boiler work, is shown in operation in the catalogue, in connection with steel car truck work. In such service as driving boring bars, tapping, reaming and various kinds of rotary work their piston air drill is pictured, and also the Monarch wood-boring machines at work in car repair yards. This company manufacture a very efficient flue cutter that can be operated by either a No. 1 piston drill or a rotary drill of equal capacity, and furnish air compressors and air hoists of all sizes and styles, also special wire-wound air hose and hose couplings.

Grinding and Polishing Machinery.—One of the most complete catalogues of grinding machinery that has been received, is that of the Diamond Machine Co., Providence, R. I. A careful examination of this 1901 catalogue of 129 pages shows not only a number of new designs, but alterations of more or less importance in almost every one of the older machines. Many of the Diamond machines are now recognized as established types, and it has been the object of this company to perfect these machines by bringing them up to the modern requirements. Besides the more familiar grinding machines for bench work, grinding machines on columns and stands and improved surface grinders, there are illustrated in the book many interesting automatic machines for grinding saws, and knives of every description, up to 120 ins. in length. The book also presents a line of lathe grinding attachments and countershafts with patent belt shifters, suspended grinding and swing-frame polishing machines, 5 and 10-wheel grinders, and spindle and screw-feed lathes, together with various attachments, such as lathe slide rests, chucks and lathe center grinders. A description of the manufacture of carborundum and carborundum wheels introduces a chapter on polishing lathes, polishing wheels and buffs, of a great variety. Each tool and device is made reference to in a complete index in the back of the catalogue and also given a word in the telegraphic code.

The Safety Car Heating and Lighting Company, of New York, have issued a catalogue entitled "Steam Heat, Pintsch Light," a very creditable book in every way. This, their latest catalogue, has 151 pages, 8¼ x 10¾ ins., is bound in green cloth, and illustrates and very briefly describes the various fittings and appliances which constitute both heating and lighting equipments. The illustrations are extensive, and in connection with the standard heating systems for both single and double circulation heaters, the standard heating system using live or exhaust steam from the locomotive and the direct steam heating system, are given large folded drawings of the floor plan showing the application of these systems to various coaches and combination cars. For particular equipments designs will be furnished on receipt of floor plan of cars showing the approximate positions of needle beams, gas tanks, equipment boxes and in a general way the position of brake cylinders. An approximate list of material required for one full equipment is given on each diagram for that particular system. Among the lighting equipment plates are a number of new and very attractive designs of lamps, such as drop bracket, drop swing bracket and combination bracket lamps, for use on the sides of the car. For detailed information relative to the systems of heating or lighting equipments, as shown in this general catalogue, will be furnished upon request at the office of the Safety Car Heating and Lighting Company, 160 Broadway, New York. This catalogue is an elaborate piece of work and is practically a text-book of car heating and lighting. The half-tone engravings are beautifully executed and the line cuts are from excellent specially prepared drawings.

Steam Boilers.—The Parker Engine Company, of San Francisco, Cal., and Drexel Building, Philadelphia, have in their 1901 catalogue of steam boilers given information about their very successful system of steam making, whereby the maximum heat is saved. In this system the progressive circulation of the feed water is from the water cylinder downward through continuous coils of tubes toward the fire and thence straight up to a separate steam chamber, thus maintaining a positive flow of the water and steam in one direction, opposite to that of the escaping gases. The claims and advantages of this boiler are fully described in the pamphlet, and are guaranteed by exceptionally high trial conditions, beside the

usual tensile and hydraulic tests. The specifications include the following: Dry steam per pound of combustible from and at 212 degrees, 11.5 lbs. Priming, foaming or lifting to be impossible, and moisture in steam not to exceed 1 per cent. under any conditions. To stand forcing to 50 per cent. above rating to date of acceptance, without leaks, or above 10 per cent. loss in economy; quick changes between no load and full load, or sudden drops in pressure from any cause; and in no case shall the circulation be reversed, the tubes overheated, or the water lifted. Ground hand hole joints to be made tight without bolts. Internal cleaning to be accomplished without shutting down, or the use of mechanical cleaners. To those interested in steam boilers, this catalogue will be found both interesting and valuable. A copy of the book can be procured by writing to the Parker Engine Company, 1041 Drexel Building, Philadelphia, Pa.

EQUIPMENT AND MANUFACTURING NOTES.

An order for pressed steel body and truck bolsters for 500 80,000-lbs. capacity cars for the Pittsburg Coal Company has been received by the Pressed Steel Car Company, of Pittsburg, Pa. The cars are being built by the Illinois Car and Equipment Company.

The Lake Shore & Michigan Southern Railway has ordered 1,500 freight cars of 80,000-lbs. capacity from the American Car and Foundry Company. The contract specifies that pressed steel body and truck bolsters shall be used in their construction. The bolsters will be furnished by the Pressed Steel Car Company, of Pittsburg.

Mr. J. W. Lowell recently resigned the position of Manager of the Railway Department of the Manhattan Rubber Manufacturing Company, New York, to become the General Sales Manager of the Woven Steel Hose and Cable Company, of Trenton, N. J., with headquarters at 32 Broadway, New York.

Simplex bolsters will be used on the 2,000 Michigan Central cars recently ordered from the American Car and Foundry Company; also 600 cars to be built for the Wheeling & Lake Erie, at the South Baltimore car shops; 400 cars for the Northern Pacific to be built at the same place, and 250 Louisville & Nashville cars to be built at the company's shops.

The Richmond Locomotive Works have just received an order from the Plant System for three six-wheel connected switching locomotives, the principal dimensions of which are as follows: Cylinders, 18 x 26 ins.; weight in working order, 108,000 lbs.; driving wheels, 50 ins. in diameter; driving wheel base, 11 ft.; 60-in. radial stay boiler; 250 tubes, 2 ins. in diameter and 12 ft. long; fire-box, 41 x 96 ins.; boiler pressure, 180 lbs. The tank capacity of the tenders is 4,000 gallons.

A new record has been established by the Pressed Steel Car Company, of Pittsburg, in the number of freight cars turned out in a day. During the week ending March 16th this company built and shipped 636 freight cars; a daily average of 106 cars. The shipments consisted of 467 hopper cars and 169 box cars.

The Standard Pneumatic Tool Company, of Chicago, manufacturers of the "Little Giant" air tools and appliances, have moved their New York offices from 619 Washington Life Building, to more commodious quarters in rooms 611, 612, 613 of the same building, this being necessitated by the increase in their business in eastern and foreign territory during the past few months. All shipments for customers in the district just mentioned will be made from New York instead of Chicago, thus expediting delivery of machines.

Mr. R. E. Janney has been appointed representative of the Sargent Company and the Railway Appliance Company in New York and the Eastern and Southern Territories. Mr. Janney will have his office at No. 1314 Havemeyer Building, Cortlandt Street, New York City, and will sell the well-known specialties of the Sargent Company, namely, open-hearth cast steel knuckles, locking parts of couplers for repairs, and a line of cast steel tools, such as car repair and machinists' hammers, wrenches; coal picks, etc., also for the Railway Appliance Company, the Gilman Brown emergency knuckle, the O'Brien coupler, and the Sargent coupling device.

Keuffel & Esser Company, New York, have established a branch house at 303 Montgomery St., San Francisco, Cal., to accommodate the steady growth of business on the Pacific Coast. John R. Carr, which firm has been acting as their agents in San Francisco, and Mr. W. E. Holcomb, traveling representative for the Keuffel & Esser Company, in that territory will be in charge of the new branch house. A very complete line of the well-known Keuffel & Esser Company drawing materials and surveying instruments will be kept in stock, so that customers there will be provided with the same facilities for obtaining these goods as are enjoyed by those further east.

An exhibition of samples and models of the Edwards window fixtures and vestibule platform trap-doors was held at the Southern Hotel in St. Louis, March 8th and 9th, for inspection by the members of the St. Louis Railway Club and their friends. These dates were chosen as being the most convenient for those interested, as the regular meeting of the St. Louis Railway Club was held on the 8th at that hotel. The exhibit was also made at the Terminal Hotel, St. Louis, on the 11th and 12th. In comparing these devices for opening and closing car windows as developed and manufactured by Mr. O. M. Edwards, Syracuse, N. Y., with the antiquated methods that are in too common use on many railroads, one is struck with the convenience and importance of these fixtures. Not only is the operation of the windows sure and easy, but the matter of hanging the sash is very simple, and the friction strips, adjusting themselves as they do, keep out any dust or cold air from the car, and also take up shrinkage or swelling of the wood, thus preventing the sash from binding and allowing it to move freely whenever the thumb catch on the window-sill is operated. These fixtures contribute greatly to the comfort and good will of the traveler.

The following sales are reported by the Bullock Electric Manufacturing Company: Glasgow Evening News, Glasgow, Scotland, three motor generators; London Daily Express, London, Eng., three motor generators; Montreal Water & Power Company, Montreal, Can., one 400-h.p. three-phase motor; Aberdeen Journal, Aberdeen, Scotland, one 30-h.p. teaser equipment and one motor generator; Carnegie Steel Company, Pittsburg, Pa., one 25-h.p. type "H" motor; Greuner & Co., Johnstown, Pa., one 30-kw. type "I" generator; Brown & Sharpe, Providence, R. I., four type "N" motors for direct connection to machine tools; Wier Frog Company, Cincinnati, Ohio, three 10-h.p. type "N" motors; Pullman Company, Pullman, Ill., two 150-kw. type "H" generators; Mosler Safe Company, Hamilton, Ohio, one 50-h.p. type "H" motor; Susquehanna Valley Electric Company, Sydney, N. Y., one 65-kw. single-phase generator; Central Lard Company, New York City, N. Y., one 65-kw. engine type generator; Buffalo Evening News, Buffalo, N. Y., one 70-h.p. type "H" motor.

The Springfield Manufacturing Company, Bridgeport, Conn., have just moved into their new plant on Mountain Grove street. The building is of modern construction, one story high and entirely fireproof. It was designed and its construction superintended by Mr. G. W. Jackman, General Manager of the company, who has had considerable experience in the construction of buildings for manufacturing purposes. In form the building, as it faces the street, is an inverted T. The rooms forming the arms of the T are: the counting room, 20 x 15 ft.; a private office, 18 x 15 ft.; a drawing room, 15 x 25 ft., and a 100 x 25-ft. pattern room. The machine room is divided into three sections. In the center is a space 20 x 120 ft. for assembling machines, and on either side a space 20 x 100 ft. for drill presses and lathe work. Beneath the floor of the shop is a pit used as a means of ventilating and also for the line shafting which drives the machinery. In the emery-wheel department, 20 x 75 ft., are four large ovens and a hydraulic press of 300 tons capacity. This company manufacture their own gas for operating two gas engines, which furnish light and power for driving the shop tools. The design of the building was made with a view to the best means of enlarging the various departments, as the increase in the company's business demands.